APPENDIX E

BIOLOGICAL ASSESSMENTS & OPINIONS

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APPENDIX E1 BIOLOGICAL ASSESSMENT PREPARED FOR U.S. FISH AND WILDLIFE SERVICE

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af	acre-feet
ALP	Alternative Licensing Process
msl	mean sea level
AOU	American Ornithologists' Union
BA	Biological Assessment
BLM	U.S. Bureau of Land Management
BMP	Best Management Practices
BO	Biological Opinion
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
cfs	cubic feet per second
CNDDB	California Natural Diversity Database
CSUC	California State University Chico
dbh	diameter at breast height
DPR	California Department of Parks and Recreation
DWR	California Department of Water Resources
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
FRSA	Feather River Service Area
GIS	Geographical Information System
ISO	Independent System Operator
LWD	large woody debris
mi^2	square miles
MW	megawatts
NEPA	National Environmental Policy Act
NOAA	National Oceanographic and Atmospheric Administration
O&M	Operations and Maintenance
ORV	off-road vehicle
OWA	Oroville Wildlife Area or Oroville Wildlife Management Area
PBO	Programmatic Biological Opinion
PG&E	Pacific Gas and Electric Company
ppt	parts per thousand
SWP	State Water Project
SWRCB	State Water Resources Control Board
USACE	United States Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WMA	Wildlife Management Areas

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this programmatic biological assessment (BA) is to review the proposed Oroville Division, State Water Project (Federal Energy Regulatory Commission Project No. 2100) Proposed Action, in sufficient detail to determine to what extent the Proposed Action may affect any of the threatened, endangered, proposed, or candidate species listed in Section 1.4. This programmatic biological assessment is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (ESA) (16 U.S.C. 1536 (c)), and follows the standards established in California Code of Regulations (CCR) Titles 14 and 23 Chapter 3**.**

1.2 OVERVIEW

The Oroville Facilities are located on the Feather River in Butte County, California, approximately 70 miles north of the City of Sacramento (Figure 5.1-1). Oroville Dam, Lake Oroville, and related facilities occupy 41,100 acres (FERC Project Boundary) in the foothills of the Sierra Nevada Mountains. The power generation components of the Oroville Facilities have a total installed generating capacity of 762 megawatts (MW). Department of Water Resources (DWR) operates and maintains the Oroville Facilities under the terms and conditions of a FERC license dated February 11, 1957. This license will expire by January 31, 2007. FERC requires DWR to file an Application for a New License by January 31, 2005, 2 years before the license expiration date. Once the application is filed, FERC will process it, request terms and conditions and prescriptions, issue its National Environmental Policy Act (NEPA) document and render its licensing decision. Relicensing of the Oroville Facilities follows the FERC approved Alternative Licensing Process (ALP). This ALP includes a collaborative process among stakeholders, of which the U.S. Fish and Wildlife Service (USFWS) is a participant, to determine Resource Actions for protection, mitigation and enhancement of resources and which will be included in the proposed terms and conditions of the license application. After license issuance, which is expected by January 2007, the Oroville Facilities will be operated according to the new license terms and conditions and implementation of Settlement Agreement Resource Actions will be initiated.

The Proposed Action that will be addressed in the FERC environmental review process and that is described in detail in Chapter 5.0, Description of Proposed Action, is the continued operation and maintenance of the Oroville Facilities for electric power generation and implementation of Resource Actions that potentially will be included in the terms and conditions in the new FERC license. The Resource Actions are being identified through the collaborative process. The No-Action Alternative to the Proposed Action is addressed in Chapter 9.0, Analysis of No-Action Alternative.

1.3 ACTION AREA

The Action Area, described in detail in Chapter 5.0, Description of Proposed Action, for listed species includes the FERC Project Boundary (Figure 5.1-1) and the lower Feather River downstream of the Fish Barrier Dam to the confluence with the Sacramento River. This area is generally consistent with the USF&WS's preliminary determination of the action area for Section 7 purposes. However, USF&WS maintains that certain project effects, such as reduction of large woody debris (LWD) recruitment, may have indirect effects extending to the Delta, beyond the Feather-Sacramento River confluence. Potential project related changes in project releases are currently being addressed within the OCAP Biological Assessment/Biological Opinion process.

1.4 SPECIES CONSIDERED

The species considered in this document are based upon the USFWS's species list for the Oroville Facilities Relicensing FERC Project No. 2100 letter, dated January 28, 2004 (Appendix A). Sensitive species and species of concern (Appendix A) are not addressed in this document as confirmed by the USFWS (pers. comm., Bogener, 2004). Overall, 15 species of wildlife and plants that are threatened, endangered, proposed threatened, or proposed endangered species are considered in this document (Table 1.4-1). Two wildlife species addressed in this document are candidates for listing (Table 1.4-2).

Table 1.4-1. Threatened, endangered, proposed threatened, or proposed endangered species.

Species	Federal Status[1]	State Status[2]
Wildlife		
Southern bald eagle (*Haliaeetus leucocephalus*)	T	SE
Giant garter snake (*Thamnophis gigas)*	T	ST
California red-legged frog (*Rana aurora draytonii*)	T	--
Delta smelt (*Hypomesus transpacificus*)	T	ST
Vernal pool fairy shrimp (*Branchinecta lynchi*)	T	
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus)*	T	--
Vernal pool tadpole shrimp (*Lepidurus packardi*)	E	--
Conservancy fairy shrimp (*Branchinecta conservatio*)	E	--
California tiger salamander (*Ambystoma californiense*)	PT	--
Plants		
Hoover's spurge (*Chamaesyce hooveri*)	T	--

Table 1.4-1. Threatened, endangered, proposed threatened, or proposed endangered species.

Species	Federal Status[1]	State Status[2]
Layne's ragwort (*Senecio layneae*)	T	SR
Hartweg's golden sunburst (*Pseudobahia bahiifolia*)	E	SE
Green's tuctoria (*Tuctoria greene*)	E	SR
Butte County (Shippee) meadowfoam (*Limnanthes floccosa* ssp. *californica)*	E	SE
Hairy Orcutt grass (*Orcuttia pilosa*)	E	SE

1 Federal Status: T=Threatened, E=Endangered, PT=Proposed Threatened.
2 State Status: SR=State-listed rare, ST=State-listed threatened, SE=State-listed endangered.

Table 1.4-2. Candidate species addressed in this BA

Species	Federal Status[1]	State Status[2]
Wildlife		
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	C	SE
Mountain yellow-legged frog (*Rana muscosa*)	C	--

[1] Federal Status: C=Candidate.
[2] State Status: SE=State-listed endangered.

2.0 CONSULTATION TO DATE

Consultation during the development of this BA includes written correspondence and Work Group and Plenary Group meetings. The consultation is summarized in the following sections.

2.1 SUMMARY OF CORRESPONDENCE

The principal consultation related written correspondence was the relicensing draft final *Study Plan Report SP-T2 Project Effects on Special Status Species* (Wildlife) *Draft Final Report* (DWR 2004a) and *Study Plan Report SP-T2 Project Effects on Special Status Plant Species Draft Final Report* DWR 2004b). These reports summarize the results of relicensing studies related to special status plant and wildlife species including species protected under the federal Endangered Species Act.

2.2 SUMMARY OF MEETINGS

As part of the FERC ALP for the application to relicense the Oroville Facilities, the USFWS participated in the collaborative process as relates to non-ESA listed species. Through this on-going process, Study Plans including *Study Plan Report SP-T2 Project Effects on Special Status Species* (*Wildlife) Draft Final Report* (DWR *2004a) and Study Plan Report SP-T2 Project Effects on Special Status Plant Species Draft Final Report* (DWR 2004b)) were cooperatively developed by Federal, State, and local governments and resource agencies, Indian Tribes, non-government organizations, and individual participants and implemented by DWR. These Study Plans and reports, as prepared by the Work Groups and reviewed by the Plenary Group, were developed to address issues identified in the formal scoping process, to fulfill regulatory requirements associated with relicensing, and to develop Resource Actions (also termed Protection, Mitigation & Enhancement Measures) that will be included in the settlement agreement.

The USFWS participated in both the Plenary Group and Work Group meetings. The USFWS attended 14 Plenary meetings from November 16, 2000 to March 23, 2004 and 36 Work Group meetings from February 22, 2001 to March 24, 2004. A list of the meetings during which the USFWS was present is included in Appendix B. In addition, USFWS staff met and informally consulted with DWR on seven dates between November 13, 2003 and April 14, 2004. These consultations focused on Section 7 compliance and development of the Biological Assessment/Biological Opinion. Issues specifically addressed included scope, species covered, species-specific conservation measures, BA format, and cumulative effects analyses.

3.0 DESIGNATED CRITICAL HABITAT

3.1 DESIGNATED CRITICAL HABITAT WITHIN THE FERC PROJECT BOUNDARY AND ACTION AREA

The Action Area for the Proposed Action does not fall within critical habitat for the listed threatened or endangered species addressed in this biological assessment.

3.2 DESIGNATED CRITICAL HABITAT IN RELATION TO FERC PROJECT BOUNDARY AND ACTION AREA

Designated critical habitat for the California red-legged frog (*Rana aurora draytonii*), delta smelt (*Hypomesus transpacificus*), and valley elderberry longhorn beetle (*Desmocerus californicus dimorphus)* are briefly described below in relation to the Action Area (FERC Project Boundary and the Feather River to the confluence with the Sacramento River).

No critical habitat is designated for the southern bald eagle (*Haliaeetus leucocephalus*) or giant garter snake (*Thamnophis gigas*).

As described in the final rule for designation of critical habitat for vernal pool crustaceans and plants (68 FR 46684-46781), per Section 4(b)(2) of the Endangered Species Act of 1973, as amended, lands owned by California Department of Fish and Game including the Oroville Wildlife Area (OWA), and lands in Butte County were excluded from the final ruling for designated critical habitat (68 FR 46745)**.** The exclusion of certain areas was based on the benefits of inclusion verses the benefit of exclusion and from information received from the California Department of Fish and Game (CDFG) (68 FR 46766)**.**

3.2.1 California Red-Legged Frog

Final ruling on critical habitat for the California red-legged frog was established by USFWS on March 13, 2001 (66 FR 14625 to 14674). This critical habitat designation includes 31 critical habitat units on lands within 28 California counties. This critical habitat designation includes areas outside the FERC Project Boundary to the north and northeast including Unit 1 on the North Fork of the Feather River (see 66 FR 14661 for map showing location of Unit). No designated critical habitat occurs in Yuba or Sacramento counties to the south of the Action Area. Unit 1 is the northeastern most of critical habitat units for the California red-legged frog and is located in Plumas and Butte counties including U.S. Forest Service managed lands (66 FR 14634). A portion of this unit occurs approximately one mile north of the FERC Project Boundary within the French Creek watershed. On April 13, 2004, the USFWS re-proposed lands within the 28 counties for designated critical habitat status. However, the re-proposal did not affect Unit 1.

3.2.2 Delta Smelt

Final ruling on critical habitat for the Delta smelt was established by USFWS on December 19, 1994 (59 FR 65256 to 65279). This critical habitat designation includes areas to the south of the City of Sacramento outside the Action Area (FERC Project Boundary and the Feather River to the confluence of the Feather and Sacramento rivers). The designated critical habitat for the Delta smelt is described as: "Areas of all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay including the contiguous Grizzly and Honker Bays; the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch) and Montezuma sloughs and the existing contiguous waters contained within the Delta as defined in Section 12220 of the California Water Code." (59 FR 65277; see 59 FR 6 5278 for map showing designated Critical Habitat).

3.2.3 Valley Elderberry Longhorn Beetle

Final ruling on critical habitat for the valley elderberry longhorn beetle was established by USFWS on August 8, 1980 (45 FR 52803 to 52807). This critical habitat designation includes two zones within Sacramento County that are 40 miles south and outside of the FERC Project Boundary and over 10 miles from the confluence of the Feather River with the Sacramento River. These zones include:

1) Sacramento Zone: An area in the city of Sacramento enclosed on the north by the Route 160 Freeway, on the west and southwest by the Western Pacific railroad tracks, and on the east by Commerce Circle and its extension southward to the railroad tracks; and

2) American River Parkway Zone: An area of the American River Parkway on the south bank of the American River, bounded on the north by latitude 30°37'30"N, on the west and southeast by Elmanto Drive from its junction with Ambassador Drive to its extension to latitude 38°37'30"N. Goethe Park and that portion of the American River Parkway northeast of Goethe Park, west of the Jedediah Smith Memorial Bicycle Trail and north to a line extended eastward from Palm Drive.

4.0 CURRENT MANAGEMENT DIRECTION

Resource and land management plans currently being implemented by DWR for the Oroville Facilities to protect wildlife and botanical resources, including threatened and endangered species, are described below and include: 1) FERC Policy on the Endangered Species Act; and 2) resource management plans and goals for bald eagles, vernal pools and Oroville Wildlife Area. In addition, the CDFG and Department of Parks and Recreation (DPR) administer resource and land management plans within the FERC Project Boundary for the OWA and Lake Oroville, respectively. These plans are also briefly described below.

4.1 FERC POLICY ON ENDANGERED SPECIES ACT

During hydropower project licensing, the FERC requires the licensee to consult with USFWS or National Oceanographic and Atmospheric Administration (NOAA) Fisheries to determine whether the agency action (issuance of a new license) is likely to jeopardize the continued existence of any federally listed or proposed endangered or threatened species or result in destruction of critical habitat (18 CFR 4.38 and 16.8). The FERC may be required to prepare a BA to identify any endangered or threatened species likely to be affected by licensing; the BA may be undertaken as an integral part of NEPA compliance. For purposes of compliance with the ESA, FERC may designate the license applicant as a nonfederal representative for informal consultation during the pre-filing consultation process. FERC works closely with the applicant to see that studies include information needed for the BA. The USFWS and/or NOAA Fisheries review the FERC BA and respond by issuing a Biological Opinion (BO). The BO analyzes FERC's assessment of effects and the states whether the USFWS and/or NOAA Fisheries concur or disagree with the measures FERC recommends for protecting threatened or endangered species.

The Federal Power Act (FPA) creates several avenues for incorporating fish and wildlife protection measures, including those addressing federally listed species, into hydropower licenses. Under Section 10(j) of FPA, the FERC is required to incorporate recommendations from the USFWS, NOAA Fisheries, and state agencies for the protection, mitigation, and enhancement of fish and wildlife potentially affected by hydropower projects. These conditions are considered by the FERC for inclusion as License articles and may be rejected by the FERC if they are inconsistent with the FPA or if FERC's own recommendations meet the management objectives (18 CFR 4.34[e][5]). The FERC is mandated to include fish and wildlife terms and conditions prescribed by federal and tribal land managers in licenses for projects on federal lands or Indian reservations (FPA, Section 4[e]). Under Section 10(a)(2) of the FPA, FERC must also consider "comprehensive plans" developed by state agencies or agencies authorized by federal law. In addition, ESA recovery plans and resource/land management plans adopted by agencies, as well as biological opinions on other actions in the same geographic area, may influence on FERC's consideration of a license application.

4.2 DWR RESOURCE MANAGEMENT PLANS AND GOALS

There are four DWR directed management plans currently in place for the Oroville Facilities that include measures to address threatened and endangered species. These plans are briefly summarized below.

4.2.1 Lake Oroville Bald Eagle Management Plan—Crystal Hill Nesting Territory

The Crystal Hill bald eagle nesting territory was first identified in 1990. The territory is located northwest of Crystal Hill summit on the Middle Fork Arm of Lake Oroville, and includes two nest sites (Nests A and B). The most recently used nest tree (Nest B) is located 1,050 horizontal feet from the high water shoreline of Lake Oroville in a ravine that is about 500 vertical feet above the high water lake elevation. This nest is not easily visible from the shoreline. Furthermore, the orientation of the ravine location, distance of the nest from water, and large trees around the nest shield it from shoreline observation. An alternate nest in the territory is approximately the same distance from the lake but is more visible.

Shoreline recreational use within the territory is uncommon and restricted to boat access. Lack of suitable coves or beaches further limits shoreline recreational use. Observed recreational use is limited to open water activities including fishing, houseboating, and water skiing. Small game hunting is allowed in this portion of the State Recreation Area along the shoreline. There is at least one nearby residence, which is located about 700 feet southwest of Nest A. High fuel loading and the presence of ladder fuels in the immediate vicinity of both nest trees increase the risk of future habitat loss due to wildfire.

Based on observations during years 2002 and 2003, the pair of eagles occupying this territory did not appear to be affected by the timing, type, or amount of recreational activities. The distance of both nests from the high water mark, screening vegetation at the nest site, and unsuitability of the territory for shore-based recreation limit the potential for recreational disturbance.

The *Lake Oroville Bald Eagle Management Plan for the Crystal Hill Nesting Territory* (DWR 2004a) (Appendix C) calls for the following measures to minimize disturbance and habitat modification:

Within the 700-acre primary zone:

- Exclude human entry during the nesting season (February through August) during years when the territory is active (adult eagles present during the breeding season).

- Prohibit major habitat manipulations such as logging, brush conversion, mining, subdivision, roads, trails, or recreation developments.

Within the 1,550-acre Secondary Zone:

- Require DPR, DWR, and U.S. Bureau of Land Management (BLM) review of all proposed activities for compatibility with bald eagle management.

- Conduct limited fuels reduction efforts to fireproof both nest trees from wildfire could be beneficial for long-term retention of the territory. These fuel load reduction activities employing hand crews would be conducted between August 31 and February 1.

At this time, no suggested closures on the shoreline or lake surface appear necessary. If adverse disturbance occurs to nesting bald eagles, appropriate measures to avoid such disturbance will be implemented (after consultation with CDFG and USFWS).

4.2.2 Lake Oroville Bald Eagle Management Plan—Potter Ravine Nesting Territory

The Potter Ravine bald eagle nesting territory is located along the southern shore of Potter Ravine approximately 1.3 miles north of the Oroville Dam. Potter Ravine is a popular destination site for recreational activity. Its proximity to the Spillway Launch Ramp, existing Potter Ravine trail system, as well as Bidwell Marina, makes it easily accessible. The cove is attractive for recreational use as it is protected from high winds and associated waves. Further, the relatively gentle shoreline topography is conducive to dispersed shoreline recreational activities including shore fishing, picnicking, and swimming.

The Potter Ravine bald eagle territory was discovered in February 2002 by DWR staff. It is unknown if this territory had been active previously. DWR and DPR immediately evaluated potential threats to this territory and initiated informal consultation with CDFG and FWS. Consultation resulted in several changes in recreation management in the vicinity of the territory. These changes, which are summarized in the *Lake Oroville Bald Eagle Management Plan for Potter Ravine* (DWR 2004b) (Appendix C) included:

- Delineation of a 175 acre primary zone which excludes human entry from February 1 through August 31.

- Establishment of a shoreline closure by DPR Superintendent Order, which included placement of buoy signage and patrol/enforcement.

- Relocation of two floating campsites outside of the primary zone.

- Realignment of an active trail construction project to minimize entry into the primary zone.

- Seasonal closure of a portion of the trail system within the primary zone.

In addition, DPR worked with the adjacent landowners to improve fencing to exclude cattle from the Recreation Area. Monitoring Lake Oroville for new, as well as known, nesting territories is to be conducted annually from February through July by DWR staff.

The *Lake Oroville Bald Eagle Management Plan for Potter Ravine* also includes a number of measures designed for future protection of the territory for as long as the bald eagle remains federally or state listed. These are summarized below:

Within the 175-acre primary zone:

- Exclude human entry during the nesting season (February through August) during years when the territory is active (adult eagles present during the breeding season).
- Prohibit major habitat manipulations such as logging, brush conversion, mining, roads, trails, or recreation developments.
- Maintain shoreline closure and associated patrol enforcement activities to limit shoreline-based recreation.
- Monitor pre-fledged young on both July 4 and July 5 to document any losses possibly related to the annual fireworks display.
- Close those portions of the trail/road system within the primary zone from February 1 through August 1.
- Maintain exclusion of hunting between Potters Ravine and Spillway Cove.
- Consider using hand crews to reduce fuels accumulations within 25 feet of nest tree. Any fuels reduction work should occur outside of the nesting season and under the supervision of a biologist familiar with bald eagle disturbance responses.

Within the 740-acre Secondary Zone:

- Require DPR and DWR review of all proposed activities for compatibility with bald eagle management.
- Maintain fencing to exclude cattle.
- Monitor issues and, if necessary, consult with CDFG and USFWS to implement additional appropriate protection measures.
- Encourage improvement of fish habitat or stocking of prey fish within identified foraging areas outside of primary zone.

4.2.3 Lake Oroville Bald Eagle Management Plan—Bloomer Nesting Territory

The Bloomer bald eagle nesting territory is located along the western shore of the North Fork of Lake Oroville approximately 3.5 miles north of the Oroville Dam. While the nest is located on BLM land within the FERC Project Boundary, private lands just west of the nest, appear to have been subdivided into multiple small parcels. The Bloomer bald eagle territory was discovered in 2000. It is unknown if this territory had been active previously. The territory has not produced offspring in the last three years.

The Bloomer nest site is located approximately midway along the North Fork Arm of Lake Oroville, which connects the main basin of the lake to the North Fork and West Branch, and thus receives a large amount of boat traffic during the recreation season (May through September). The popular Bloomer Point Boat-In Campground is approximately 1.5 miles north-northwest of the territory. During the recreational season, a floating restroom is located across the lake in Bloomer Ravine. Shoreline based recreation is limited to dispersed fishing from boats and overnight moorage of houseboats. No recreational use of upland habitats within the territory has been identified. The shoreline in the area is generally not suitable for houseboat mooring or shoreline camping, but across the channel at the Forman Creek Boat-in Campground (more than 1 mile away) camping occurs above the shoreline. Shoreline camping is illegal within the nest territory area. This pair appears to be extremely sensitive to boat activity within 200 yards of the nest.

To protect the Bloomer bald eagle nest territory from unnecessary human disturbance and habitat degradation, DWR developed the *Lake Oroville Bald Eagle Management Plan Bloomer Nesting Territory* (DWR 2004c) (Appendix C) that includes the following recommendations.

Within the 215-acre primary zone:

- Exclude human entry during the nesting season (February through August) during years when the territory is active (adult eagles present during the breeding season).

- Prohibit major habitat manipulations such as logging, brush conversion, mining, roads, trails, or recreation developments.

Within the 720-acre Secondary Zone:

- Require DPR, BLM, and DWR review of all proposed activities for compatibility with bald eagle management.

- Install signage along the shoreline to prevent boat moorage and associated shoreline recreational disturbance.

4.2.4 Land Management Plan for the Protection of Potential Habitats of Special Status Species of Fairy and Tadpole Shrimp

DWR completed an assessment of vernal pools on State lands within the project boundary for state and federally listed plants and wildlife and their habitats that are dependent on vernal pool habitat. Wildlife dependent on vernal pools include three invertebrates—the vernal pool fairy shrimp and Conservancy fairy shrimp, both federally listed as endangered, and the vernal pool tadpole shrimp, federally listed as threatened. There are at least two federally threatened and three federally endangered plant species potentially occurring in the project vicinity that inhabit vernal pools. However, DWR surveys in vernal pools and other wetlands did not identify these plant species. Surveys were not conducted for vernal pool invertebrates but they are assumed to be present in suitable habitat.

The results of the vernal pool assessment were used to develop a *Land Management Plan for the Protection of the Potential Habitats of Special Status Species of Fairy and Tadpole Shrimp* (DWR 2004d) (Appendix C). The purpose of this management plan is to identify opportunities for protection and enhancement of vernal pool habitats during facility operations and maintenance. This vernal pool land management plan was submitted to the USFWS for review and consultation and the USFWS concurs with the management strategies contained in the plan. DWR will submit the management plan to FERC as an amendment to the current FERC hydropower license. Should any of the protected plant species later be found in vernal pools within the FERC Project Boundary, it may be necessary to reevaluate the protection measures contained in this plan in coordination with USFWS.

In an effort to protect or enhance vernal pools, the *Land Management Plan for the Protection of the Potential Habitats of Special Status Species of Fairy and Tadpole Shrimp* was prepared and includes several land management strategies summarized below.

- Reduce sedimentation by abandoning or adding rock to unsurfaced roads, creating sediment barriers along roads, and ensuring proper culvert design at drainage crossings.

- Conduct all earth-moving activities in such a manner as to avoid the direct transport of sediment into vernal pools and conducting vernal pool assessments prior to work within 250 ft of pools.

- Avoid soil disking or disturbance of soils in areas containing vernal pools.

- Use a staged approach to exclude off-road vehicle (ORV) traffic:

  Step 1) increase the number and scope of signs in sensitive areas;

Step 2) increase patrol and public education related to ORV use;

Step 3) increase enforcement; and

Step 4) install exclusionary fencing in localized situations where other protection measures have failed.

- Explore opportunities to reduce pesticide use and identify alternative means of weed control. Area-wide broadcast methods (aerial spraying) should be avoided.

In some specific locations and cases, measures included in the management plan may require Section 7 consultation with the USFWS.

4.3 CALIFORNIA DEPARTMENT OF FISH AND GAME AND CALIFORNIA DEPARTMENT OF PARKS AND RECREATION PLANS

4.3.1 CDFG Oroville Wildlife Area Management Plan

The OWA was established in 1968, and the management of approximately 5,500 acres of the Oroville Borrow Area was transferred from DWR to CDFG. The OWA Management Plan was prepared in 1978 and had the stated purpose of providing "for the preservation and enhancement of the fish and wildlife resources of the OWA and for reasonable use and enjoyment by the public" (CDFG 1978). The area consists of riparian habitat along the river, ponds and ditches with aquatic vegetation, sparsely vegetated areas, and dredge tailing ridges. Approximately 90 percent of the OWA had been mined. Habitat improvement projects including tree and shrub plantings; herbaceous plantings; and water development of ponds, potholes, and level ditchings had been conducted by 1973. The objectives for wildlife were to: 1) maintain wildlife resources and habitat; 2) increase the quality and distribution of cover, water, and food; 3) maintain surveillance of the area to enforce protective laws and regulations; and 4) maintain reasonable access to accommodate use and enjoyment by the public. This plan does not address any specific measures relating to state and federally listed threatened or endangered species.

4.3.2 CDFG Oroville/Spenceville Management Plan After P-R Cutbacks of 1985/86 Fiscal Year

The *Oroville/Spenceville Management Plan After P-R Cutbacks of 1985/86 Fiscal Year* (CDFG 1985) provided further management direction to the OWA Management Plan prepared in 1978. As stated in the management plan, the purpose of the OWA acquisition was to preserve protect and perpetuate habitats required for wildlife and fish and secondly to provide recreational opportunities to the public including hunting, and fishing, nature study, birding, photography and other outdoor interests.

Under this plan, CDFG is required to consult and coordinate activities with DWR and DWR has the right to use the OWA for construction, repairs, operation and maintenance

of the water projects. The plan describes the resources within the OWA including and fish, wildlife and plant resources, borrow sources of the dredger piles, and includes recommendations for additional road closures, habitat improvement focused on recreational wildlife species (waterfowl, dove and turkey and warm water fishery), provisions for the protection of heron and egret rookeries and confirmed raptor nesting sites and funding for management activities and requirement that non-appropriate users be required to support their use of the areas of OWA. No data were available regarding species of special concern at the time the plan was developed and no management objectives or actions for special status species were addressed.

4.3.3 CDFG Management Plan for the Thermalito Afterbay Unit of the Oroville Wildlife Area

DWR transferred an easement to CDFG on January 24, 1986 for management of the Thermalito Afterbay water surface and adjoining lands for use as a wildlife area and an easement to allow CDFG access and management responsibilities. DWR retained the right to use the property for construction, reconstruction, repair, operation, or maintenance of the facilities of the State Water Project. CDFG became responsible for all costs associated with operation and maintenance of this property as part of the OWA. CDFG prepared the Management Plan for the Thermalito Afterbay Unit of the Oroville Wildlife Area (CDFG no date). The management, policy recommendations and action plan was developed to address the following objectives:

1) Preserve, protect and perpetuate wetland habitats needed by fish and wildlife, especially migratory and resident waterfowl and

2) Lessen disturbance from humans and dogs during waterfowl and pheasant nesting season.

The first object was accomplished by establishing waterfowl brood ponds, with CAL Marsh Project funding, that created stable water levels from that in the rest of the Afterbay which benefited nesting waterfowl and planting of waterfowl nest cover/forage plots. The second objective was accomplished by closing roads in the area, posting signs for no vehicles and only allowing public use as set forth in Title 14 of the California Fish and Game Code.

4.3.4 DPR Lake Oroville Resource Management Plan and General Development Plan

The DPR Lake Oroville Resource Management Plan, and General Development Plan, prepared in 1973 (DPR 1973), indicate that “landscape values and vegetation elements shall be protected against scarring and degradation to the fullest practicable extent….” (DPR 1973). Further landscaping is to be used to harmonize recreational developments with the natural environment and mitigate for environmental impacts. Neither of these

plans has any specific measures relating to state and federally listed threatened or endangered species.

5.0 DESCRIPTION OF PROPOSED ACTION

5.1 OVERVIEW OF OROVILLE DIVISION, STATE WATER PROJECT AND OPERATION

5.1.1 FERC Relicensing Process

The Oroville Facilities are located on the Feather River in Butte County, California, approximately 70 miles north of the City of Sacramento (Figure 5.1-1). Oroville Dam, Lake Oroville, and related facilities occupy 41,100 acres in the foothills of the Sierra Nevada Mountains. The power generation components of the facilities have a total installed generating capacity of 762 MW. DWR operates and maintains the Oroville Facilities under the terms and conditions of a FERC license dated February 11, 1957. This license will expire on January 31, 2007. FERC requires DWR to file an Application for New License by January 31, 2005, 2 years before the license expiration date.

The Proposed Action addressed in this Biological Assessment is the continued operation and maintenance of the Oroville Facilities for electric power generation, along with implementation of minimization and conservation measures that have been developed in coordination with USF&WS, and the terms and conditions of the new FERC license and settlement agreement, developed through the collaborative process.

Through the collaborative process, DWR is developing a set of potential Resource Actions that are intended to be incorporated into the FERC License as terms and conditions. These terms and conditions are expected to be better defined during 2004, and will be evaluated in the January 2005 PDEA and subsequent FERC Environmental Impact Statement (or Environmental Assessment) and California Environmental Quality Act Environmental Impact Report. For purposes of this programmatic BA, activities (e.g., construction, herbicide use) associated with the potential Resource Actions are addressed, not the specific Resource Actions themselves.

5.1.2 Project Facilities

The Oroville Facilities were developed as part of the State Water Project (SWP), a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to store and distribute water to supplement the needs of urban and agricultural water users in northern California, the San Francisco Bay area, the San Joaquin Valley, and southern California. The Oroville Facilities are also operated for flood management and power generation, and to improve water quality in the Delta, provide recreation, and enhance fish and wildlife.

FERC Project No. 2100 includes Oroville Dam and Reservoir, three power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant), Thermalito Diversion Dam, the Feather River Fish Hatchery and Fish Barrier Dam, Thermalito Power Canal, OWA, Thermalito Forebay and Forebay

Dam, Thermalito Afterbay and Afterbay Dam, and transmission lines, as well as a number of recreational facilities. An overview of these facilities is provided on Figure 5.1-1. The Oroville Dam, along with two small saddle dams, impounds Lake Oroville, a 3.5-million acre-feet (af) capacity storage reservoir with a surface area of 15,810 acres at its normal maximum operating level.

The hydroelectric facilities include the Hyatt Pumping-Generating Plant, which is the largest of the three power plants with a capacity of 645 MW. Water from the six-unit underground power plant (three conventional generating and three pumping-generating units) is discharged through two tunnels into the Feather River just downstream of Oroville Dam. The plant has a generating and pumping flow capacity of 16,950 cubic feet per second (cfs) and 5,610 cfs respectively. Other generation facilities include the 3-MW Thermalito Diversion Dam Power Plant and the 114-MW Thermalito Pumping-Generating Plant.

Thermalito Diversion Dam, 4 miles downstream of the Oroville Dam, creates a tail water pool for the Hyatt Pumping-Generating Plant and is used to divert water to the Thermalito Power Canal. The Thermalito Diversion Dam Power Plant is a 3-MW power plant located on the left abutment of the Diversion Dam. The power plant releases a maximum of 615 cfs of water into the river.

The Power Canal is a 10,000-foot-long channel designed to convey generating flows of 16,900 cfs to the Thermalito Forebay and pump-back flows to the Hyatt Pumping-Generating Plant. The Thermalito Forebay is an off-stream regulating reservoir for the 114-MW Thermalito Pumping-Generating Plant. The Thermalito Pumping-Generating Plant is designed to operate in tandem with the Hyatt Pumping-Generating Plant and has generating and pump-back flow capacities of 17,400 cfs and 9,120 cfs, respectively. When in generating mode, the Thermalito Pumping-Generating Plant discharges into the Thermalito Afterbay, which is contained by a 42,000-foot-long earth-fill dam. The Afterbay is used to release water into the Feather River downstream of the Oroville Facilities, helps regulate the power system, provides storage for pump-back operations, and provides recreational opportunities. Several local irrigation districts receive water from the Afterbay. Water level fluctuations in the Afterbay vary ranging up to 4.8 feet weekly during power generation periods.

The Feather River Fish Barrier Dam is downstream of the Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the low-flow channel of the Feather River between the dam and the Afterbay outlet, and provides attraction flow for the hatchery. The hatchery was intended to compensate for spawning grounds lost to returning salmon and steelhead trout from the construction of Oroville Dam. The hatchery can accommodate an average of 8,000 adult fish annually.

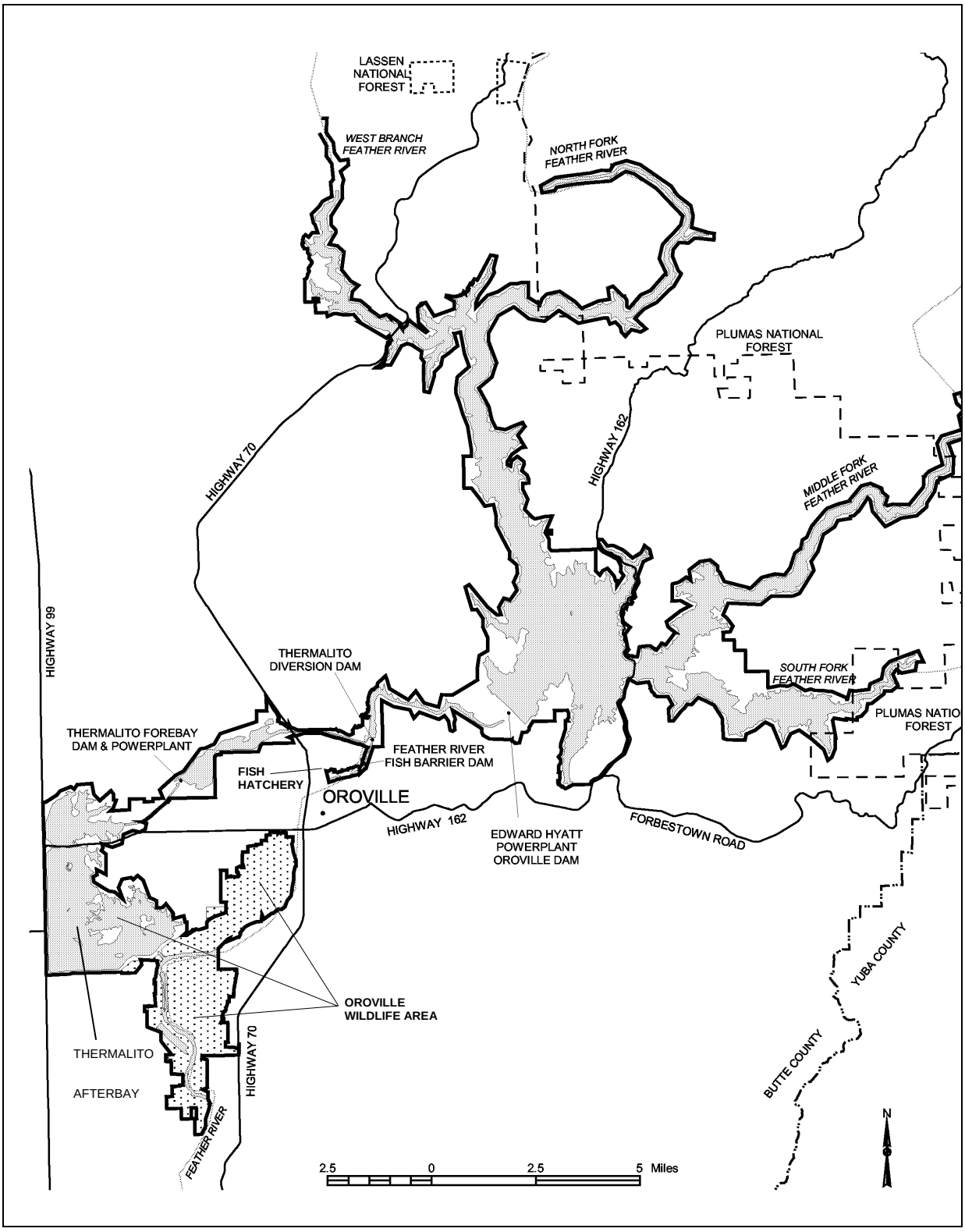

Figure 5.1-1. Oroville Facilities FERC Project Boundary

The Oroville Facilities support a wide variety of recreational opportunities. These include: boating (several types), fishing (several types), fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, hunting, and visitor information sites with cultural and informational displays about the developed facilities and the natural environment. There are major recreation facilities at Loafer Creek, Bidwell Canyon, the Spillway, North and South Thermalito Forebay, and Lime Saddle. Lake Oroville has two full-service marinas, five car-top boat launch ramps, ten floating campsites, and seven dispersed floating toilets. There are also recreation facilities at the Visitor Center and the OWA.

The OWA comprises approximately 11,000-acres west of Oroville that is managed for wildlife habitat and recreational activities. It includes the Thermalito Afterbay and surrounding lands (approximately 6,000 acres) along with 5,000 acres adjoining the Feather River. The 5,000-acre area straddles 12 miles of the Feather River, which includes willow and cottonwood lined ponds, islands, and channels. Dispersed recreation (hunting, fishing, and bird watching) occurs throughout the OWA. Developed recreation sites, include the Monument Hill day use area, model airplane grounds, three boat launches on the Afterbay and two on the river, and two primitive camping areas. CDFG's habitat enhancement program includes installation and maintenance of wood duck nest-boxes and dry land farming for nesting cover and improved wildlife forage. Limited gravel extraction also occurs in a number of locations.

5.2 CURRENT OPERATIONS

Operation of the Oroville Facilities varies seasonally, weekly and hourly, depending on hydrology and the objectives DWR is trying to meet. Typically, releases to the Feather River are managed to conserve water while meeting a variety of water delivery requirements, including flow, temperature, fisheries, recreation, diversion and water quality. Lake Oroville stores winter and spring runoff for release to the Feather River as necessary for project purposes. Meeting the water supply objectives of the SWP has always been the primary consideration for determining Oroville Facilities operation (within the regulatory constraints specified for flood control, in-stream fisheries, and downstream uses). Power production is scheduled within the boundaries specified by the water operations criteria noted above. Annual operational planning is conducted for multi-year carry over. The current operating plan calls for retaining half of the Lake Oroville storage at or above 1 million af for subsequent years; however, this does not limit draw down of the reservoir below that level. Additional water would be released from Lake Oroville if conditions are drier than expected or it there is a need for additional water downstream. The operations plan is updated regularly to reflect changes in hydrology and downstream operations. Typically, Lake Oroville is filled to its maximum annual level of up to 900 feet above mean sea level (msl) in June with a water surface area of 15,810 acres and then can be lowered as necessary to meet downstream requirements, to its minimum level in December or January. During drier years, the lake may be drawn down more and may not fill to the desired levels the following spring. Project operations are directly constrained by downstream operational

constraints and flood management criteria as described below. The annual cycle generally involves raising lake levels from November through May or June in most years followed by rapidly decreasing water levels until the initial of fall precipitation and runoff. Historic Lake Oroville water surface elevations have ranged from a high of 900 feet msl to a low of about 640 feet msl. The shoreline covers 167 miles at maximum operating storage.

Water level fluctuations in the Diversion Pool water surface are minimal and normally vary within a range of 222.5 to 224.5 feet msl for a maximum water surface elevation change of two feet (excluding spill conditions). Likewise, Thermalito Forebay generally operates with minimal fluctuations in water surface elevation ranging between 221.0 and 224.5 feet msl. Increased variability in water surface elevation occurs in the Power Canal as the water surface elevation reflects the difference between the Thermalito Forebay and Diversion Pool water surface elevations. Water surface elevation fluctuations of four to six feet can occur in this concrete lined channel.

Water level fluctuations occur on a weekly basis within the Thermalito Afterbay. These water level changes are minor in comparison to the Lake Oroville water level fluctuations. The elevation changes in the Afterbay generally range between 127 and 135 feet msl. However, water surface elevation fluctuations between 124 and 136 feet (12 feet total fluctuation) can occur.

5.2.1 Downstream Operations

An August 1983 agreement between DWR and CDFG set criteria and objectives for flow and temperatures in the low flow channel and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement (1) establishes minimum flows between Thermalito Afterbay Outlet and Verona which vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood management, failures, etc.; (3) requires flow stability during the peak of the fall-run Chinook spawning season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the later spring/summer for shad and striped bass.

5.2.1.1 Instream Flow Requirements

The Oroville Facilities are operated to meet minimum flows in the Lower Feather River as established by the 1983 agreement (see above). The agreement specifies that Oroville Facilities release a minimum of 600 cfs into the Feather River from the Thermalito Diversion Dam for fisheries purposes. This is the total volume of flow from the diversion dam outlet, diversion dam power plant, and the Feather River Fish Hatchery pipeline.

Generally, the instream flow requirements below Thermalito Afterbay are 1,700 cfs from October through March, and 1,000 cfs from April through September. However, if runoff for the previous April through July period is less than 1,942,000 af (i.e., the 1911-1960 mean unimpaired runoff near Oroville), the minimum flow can be reduced to 1,200 cfs

from October to February, and 1,000 cfs for March. A maximum flow of 2,500 cfs is maintained from October 15 through November 30 to prevent spawning in overbank areas that might later become de-watered.

5.2.1.2 Temperature Requirements

The Diversion Pool provides the water supply for the Feather River Fish Hatchery. The hatchery objectives are:

- September - 52°F
- October and November - 51°F
- December through March - 55°F
- April through May 15 - 51°F
- May 16-31 - 55°F
- June 1-15 - 56°F
- June 16 through August 15 - 60°F
- August 16-31 - 58°F

Between April and November, a temperature range of plus or minus 4°F is allowed to meet temperature objectives for the Feather River downstream of the Afterbay Outlet. During the fall months, after September 15, the temperatures must be suitable for fall-run Chinook. From May through August, they must be suitable for shad, striped bass, and other warm water fish.

The National Marine Fisheries Service (now NOAA Fisheries) has also established an explicit criterion for steelhead trout and spring-run Chinook salmon. Included as a reasonable and prudent measure in the biological opinion on the effects of the Central Valley Project and SWP on Central Valley spring-run Chinook and steelhead; DWR is required to control water temperature at Feather River mile 61.6 (Robinson's Riffle in the low-flow channel) from June 1 through September 30. This measure requires water temperatures less than or equal to 65°F on a daily average. The requirement is not intended to preclude pump-back operations at the Oroville Facilities needed to assist the State of California with supplying energy during periods when the California Independent System Operator (ISO) anticipates a Stage 2 or higher alert.

The hatchery and river water temperature objectives sometimes conflict with temperatures desired by agricultural users. Under existing agreements, DWR provides water for the Feather River Service Area (FRSA) contractors. The contractors claim a need for warmer water during spring and summer for rice germination and growth (i.e., 65°F from approximately April through mid May, and 59°F during the remainder of the growing season). There is no obligation for DWR to meet the rice water temperature goals. However, to the extent practical, DWR does use its operational flexibility to accommodate the FRSA contractor's temperature goals.

5.2.1.3 Water Diversions

Monthly irrigation diversions of up to 190,000 af are made from the Thermalito Complex during the May through August irrigation season. Total annual entitlement of the Butte and Sutter County agricultural users is approximately 1 million af. After meeting these local demands, flows into the lower Feather River continue into the Sacramento River and into the Sacramento-San Joaquin Delta. In the northwestern portion of the Delta, water is pumped into the North Bay Aqueduct. In the south Delta, water is diverted into Clifton Court Forebay where the water is stored until it is pumped into the California Aqueduct.

5.2.1.4 Water Quality

Flows through the Delta are maintained to meet Bay-Delta water quality standards arising from DWR's water rights permits. These standards are designed to meet several water quality objectives such as salinity, Delta outflow, river flows, and export limits. The purpose of these objectives is to attain the highest water quality, which is reasonable, considering all demands being made on the Bay-Delta waters. In particular, they protect a wide range of fish, including Chinook salmon, Delta smelt, and striped bass, and the habitat of estuarine-dependent species.

5.2.2 Flood Management

The Oroville Facilities are an integral component of the flood management system for the Sacramento Valley. During the wintertime, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE). Under these requirements, Lake Oroville is operated to maintain up to 750,000 af of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by the USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with the USACE.

The flood control requirements are designed for multiple use of reservoir space. During times when flood management space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through March, the maximum allowable storage limit (point at which specific flood release would have to be made) varies from about 2.8 million af to 3.2 million af to ensure adequate space in Lake Oroville to handle flood flows. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry while maintaining adequate flood protection. When the wetness index is high in the basin (i.e., wetness in the watershed above Lake Oroville), the flood management space required is at its greatest amount to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next

flood season. During flood events, actual storage may encroach into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

The Oroville Facilities along with other State Water Project Facilities and the Central Valley Projects are required to operate in compliance with objectives in the 1995 Water Quality Control Plan (SWRCB 2000) and requirements of various Biological Opinions issued by the Service and National Marine Fisheries Service to protect special-status species and designated critical habitats including Delta smelt. Two objectives of the Water Quality Control Plan related to the Delta smelt are: 1) salinity objectives for managed portions of Suisun Marsh to protect vegetation, from excessive salinity in channels and soil water and 2) Sacramento and San Joaquin River flow objectives to provide attraction and transport flows and suitable habitat for various life stages of aquatic organisms including Delta smelt and Chinook salmon.

5.3 DESCRIPTION OF CURRENT MAINTENANCE ACTIVITIES

Maintenance activities for the Oroville facilities are implemented by several land management agencies including DWR, CDFG, and DPR.

Gravel harvest, both on a commercial basis and at a more limited scale by project land management agencies for maintenance activities, also occurs in the OWA. Major maintenance activities conducted throughout the Oroville Facilities are ongoing and occur at the following facilities:

- Roads (paved, gravel and dirt roads and roads associated with trails and levees);
- Recreation facilities such as boat ramps, marinas, cartop boat launch sites and associated parking lots;
- Recreation campgrounds and parking lots;
- Designated recreation day use areas and parking lots;
- Bridges;
- Levees;
- Diversion structures; and
- Transmission line corridors and associated facilities.

Facilities affected by maintenance activities cover about 6,249.4 acres (Table 5.2-1) Current maintenance activities, which are described below, are anticipated to continue throughout the life of the new FERC license.

Table 5.2-1 Facilities and areas within FERC project boundary requiring project maintenance.

Project Facility	Acreage
Roads (all roads including those along trails and levees)	867.84
Habitat improvement areas (including brood ponds, upland areas of nest cover and forage enhancement in Thermalito Afterbay)	87.15
General recreation (naturally vegetated undeveloped land)	3,923.25
Transmission lines and right-of-way	76.11
Cemetery (Thompson Flat/Pioneer cemetery)	6.49
Miscellaneous disturbed areas (graded areas beside roads or other facilities)	647.67
Recreation campgrounds (campsites and boat in and primitive campgrounds and associated parking lots)	73.07
Recreation day use facilities parking lots, picnic areas, shooting areas, the Foreman Creek road network area, Swim Beach, Model Airplane Club and Group Staging Area, recreation facilities such as Loafer Recreation Area, the Bidwell Canyon Visitor's Center, Campfire circle and parking lots	99.22
Recreation facilities (areas with landscaping including entrance area to Loafer Creek Recreation Area, the Bidwell Canyon Visitor's Center, Campfire Circle and associated parking lots	8.16
Recreation trails	87.54
Project facilities (dams, fish hatchery, equipment storage areas, power canal, spillway, sewer ponds, tanks and associated parking lots	292.69
Recreation boating facilities (boat ramps, marinas, cartop launch sites and associated parking lots)	80.22
Total	6,249.40

5.3.1 Road Maintenance

Approximately 870 acres of roads and 90 acres of trails occur in the FERC Project Boundary. Maintenance activities associated with roads and parking areas vary by type of surface material (dirt, gravel paved). In general, road maintenance consists of maintaining the road surface, controlling vegetation along roadsides, and cleaning ditches and culverts to ensure drainage. Dirt and gravel road surfaces are maintained primarily by grading in spring and in fall/winter. However, herbicide treatments are infrequently used to supplement grading in some locations. Paved road surfaces are repaved on approximately 10-year intervals. The amount of roadside vegetation treatment varies by type of road and use standards. Along high-speed roads, mowing or herbicides are used on an annual basis to control herbaceous vegetation on the shoulders and woody vegetation is often mechanically removed to improve site distances and public safety. Mowing and herbicides are also used to control vegetation along high use trails.

5.3.2 Recreation Facilities

Maintenance activities at recreation areas within the FERC Project Boundary occur regularly and year round and focus on campgrounds, day use areas, entrance areas and parking lots and trails. Maintenance activities include pesticide use to control undesirable rodents, insects, and vegetation at campgrounds, boat ramps and other recreation sties around Lake Oroville as well as fuels management and to improve visibility for facilities inspection. Other activities include building maintenance including maintaining parking lot surfaces and drainage controls.

5.3.3 Bridge Maintenance

A wide variety of bridge types occur within the FERC Project Boundary, ranging from small wooden structures associated with trails to state highway bridges spanning Lake Oroville. Maintenance activities associated with bridges, includes safety inspections, repainting, and redecking. Maintenance activities, such as sandblasting and repainting, are scheduled to avoid the raptor-nesting season. In cases where it is not possible to avoid work during the breeding season, the work area is screened to limit disturbance to raptors nesting nearby. Pre-project surveys are conducted in the vicinity of the bridges scheduled for maintenance to determine locations of sensitive raptor nests, responses to disturbance, and to better define the breeding period (March to August) for birds at that particular site. This information is provided to maintenance staff for project planning and prior to maintenance or inspection activities.

5.3.4 Dams and Levees

Pesticides and herbicides are used to control undesirable rodents, insects, and vegetation along levees on the Thermalito Forebay Dam and Thermalito Afterbay Dam and OWA levees. Ground squirrels are controlled by DWR along the Thermalito Forebay and Thermalito Afterbay levees using bait stations to limit non-target and secondary species poisoning. DWR, CDFG and DPR utilize herbicides to control vegetation at specific locations for specific purposes including the following: fuels management, noxious weed control, public safety, and to improve visibility for facilities inspection.

The Thermalito Afterbay Dam and Thermalito Forebay Dam are sprayed on an annual basis to facilitate structural integrity inspections. DPR spot treats noxious weeds along the wetland edge of the Thermalito Forebay, and CDFG uses aerial spraying to control purple loosestrife along portions of the Thermalito Afterbay margin. DWR, CDFG and DPR have license pesticide applicators that fully comply with safety application criteria and reporting requirements.

Neither DPR nor CDFG use chemicals on a regular basis in the FERC Project Boundary for vertebrate pest control. However, Butte County Mosquito Abatement Department and the City of Oroville annually treat substantial areas within the FERC Project Boundary for mosquito abatement including the Thermalito Afterbay and OWA**.**

5.3.5 Transmission Line Rights-of-Way Maintenance

Approximately 11.3 miles of overhead transmission lines are included in the project license. The rights-of-way for these lines require regular trimming of trees to maintain vegetation clearances and to reduce danger of fire. These transmission lines, which are located in the same transmission line corridor to the Hyatt Power plant Switchyard, include the following:

- The BUS line, a 230-kV overhead transmission line extending 9 miles form the Hyatt Power plant Switchyard to Pacific Gas and Electric Company's Table Mountain/substation and

- A 230-kV overhead transmission line that extends approximately 2.3 miles from the Thermalito Switchyard to PG&E's Table Mountain Substation.

Access to portions of the transmission lines is largely along an unmaintained access road/jeep trail and by foot.

The majority of the transmission line corridor is located in annual grassland habitats, which do not require vegetation treatment or other regular maintenance activity besides yearly inspections. However, the BUS line crosses oak and foothill pine habitats between the Hyatt Switchyard and south Table Mountain. Maintenance activities in this portion of the transmission line corridor includes pruning or topping trees within 30 feet of the transmission lines using mechanical methods. Where active raptor nests occur on the transmission line towers mechanical treatments within that portion of corridor are scheduled for times outside the breeding season and human access avoided during these periods.

5.3.6 OWA Gravel Harvest

Gravel harvest currently occurs within the portion of the OWA, which straddles the Feather River. Piles of barren gravel/cobble, called dredger piles, are remnants of hydraulic mining in the 1800s and provide a large source of gravel for maintenance.

These dredger piles cover approximately 615 acres within the OWA. Large scale, commercial gravel harvest activities are not under the jurisdiction of DWR. While this commercial gravel lease is administered by DWR, it evolved from a land transfer between CDFG and local commercial gravel interests. DWR maintains leases with local companies for the mining and use of gravel within the OWA. These areas are all located within the floodplain of the Feather River and provide significant gravel resources for projects through the surrounding area of the county.

5.4 DESCRIPTION OF ACTIVITIES ASSOCIATED WITH RESOURCE ACTIONS

After January 2007, the Oroville Facilities will be operated according to the terms and conditions included in the new FERC License under the terms and conditions included in the Settlement Agreement. These terms and conditions will include a number of

Resource Actions designed to mitigate and enhance environmental resources within the FERC Project Boundary and downstream to the confluence of the Feather with the Sacramento rivers. Each Resource Action includes one or more activities that DWR will implement in the Action Area during the life of the license. The specific Resource Actions, their timing and geographic locations are unknown until a Settlement Agreement is reached, however, the potential activities associated with implementing the Resource Actions will be relatively small, site specific and localized. The anticipated activities associated with Resource Actions are briefly described below.

5.4.1 Land-Based Construction

Land based construction may be required for new buildings, fish habitat improvement structures, boat ramps, parking lots, campgrounds, marinas, hatchery ponds, small or other facilities needed for project operations and maintenance. These construction activities would all result in a one-time permanent loss of terrestrial habitat and would also involve ground disturbance and vegetation removal. Earthmoving and excavation associated with this type of construction would involve soil disturbance greater than 6-inches depth.

A number of maintenance activities and protective Resource Actions may also result in some minor construction, as well as associated ground disturbance and vegetation removal. Examples include: vehicle barrier construction and placement (wire and chain link fencing, K-rails, bollard fences, gravel piles and log booms); relocation of project facilities for resource protection; construction and maintenance of trails and roads (grading, graveling, paving, drainage control); installation of drainage and erosion controls to prevent sedimentation; lake and river bank modifications to place rock or large woody debris; and engineering and maintenance activities to prevent sediment discharge from project facilities, areas of abandonment or restoration; drainage control and installation of sediment traps. In addition, explosives could be required for some construction related activities.

5.4.2 Equipment Access

Disturbance from construction related equipment access would be short term involving vegetation damage but no vegetation removal and minor soil disturbances.

5.4.3 Access Improvements

Activities associated with Resource Actions related to access improvements would consist of minor and short-term construction and could potentially require ground disturbance, vegetation removal, and grading.

5.4.4 Irrigation System Development

Activities associated with Resource Actions that involve revegetation of disturbed areas or the establishment of forage plots for wildlife may result in minor localized disturbance

from installation of irrigation system components (pipes, hoses, pumps, drip systems, water tanks), excluding well and ditch development and construction.

5.4.5 In-water Construction

A number of Resource Actions may involve in water construction. In-water construction activities include all in-channel and in-lake soil or vegetation disturbing activities, such as gravel placement, bed ripping, side channel creation and maintenance, and dam/levee construction. These activities will typically involve heavy equipment use.

5.4.6 Bank Modification

If Resource Actions require placement of rock or large woody debris on the lake edges or riverbanks, heavy equipment would be needed for placement of the structures. Vegetation may be damaged through crushing or removed for equipment access.

5.4.7 Road and Trail Construction and Maintenance

Construction of new roads or trails would require vegetative removal and soil disturbance including earthmoving activities.

Maintenance activities for existing roads and trails may include grading, paving, placement of gravel, drainage control activities or herbicide use.

5.4.8 Herbicide and Pesticide Use

Localized use of herbicides and/or pesticides required implementing resource actions directed at controlling pest species or reducing fire hazards will be in accordance with applicable regulations.

5.4.9 Fertilizer Use

Resource Actions associated with waterfowl habitat enhancements could require applying commercial fertilizer to uplands, either by ground or aerial methods.

5.4.10 Seasonal Closure of Recreation Areas

Seasonal closure of recreation areas or land areas to certain types of public use may be required for resource protection. Types of public use that may be affected include camping, dog training, hiking, and shoreline moorage.

5.4.11 Signage and Fencing

Some Resource Actions may require signage to warn and/or educate the public, and fencing to restrict assess. Both activities would involve minor ground disturbance for installation of signs or fences. Fencing that could be installed would be either standard wire or chain link.

5.4.12 Native and Non-Native Species Reintroduction

Resource Actions may include introduction or re-introduction of fish (native and non-native) into waters within the FERC Project Boundary for recreation or mosquito abatement purposes. Landscaping around some project facilities may require the use of non-native plants.

Both small scale and large scale planting activities may be needed to revegetate certain areas. Revegetation would include minor soil disturbance, such as fencing, irrigation and herbicide/pesticide use, and fertilization.

Vegetation type conversion would require changing one type of vegetation to another and would be generally associated with landscaping, wildlife habitat improvement projects, and certain types of herbicide applications.

5.4.13 Vegetation Removal

Short-term removal of vegetation may be associated with a number of Resource Actions. This activity could include pruning, mowing, herbicide treatment, grading, tree felling, brush cutting, and earth fill activities.

5.4.14 Soil Disturbance

Short-term and long-term soil disturbance may be required to implement many Resource Actions. This activity would include major and minor levels of soil disturbance related to grading, disking, excavation, planting and earthmoving.

5.4.15 Human Disturbance and Activity

Major and minor increases in localized human activity may be needed to implement most of the Resource Actions. This activity could be either short-term or long-term. Further, recreation Resource Actions may lead to increased long-term human activity.

Patrol and enforcement, as well as resource monitoring would include minor human/vehicle related activities for resource protection, project security, law enforcement or facility inspection.

5.4.16 Sediment Control Activities

Engineering and maintenance activities would be required to prevent sediment discharge from project facilities in association with some Resource Actions. These activities would include soil disturbance such as road grading, placement of gravel, abandonment and restoration actions, drainage control and installation of sediment traps.

5.4.17 Administrative Activities

Planning, adaptive management or monitoring activities would be required to implement some Resource Actions. These activities would not involve physical or biological changes to the environment. An administrative change in ownership or management responsibility such as addition or removal of lands from the FERC Project Boundary may be an activity associated with Resource Actions.

5.4.18 Flow Changes in the Feather River and Water Level Changes in Project Reservoirs

Flow changes in the Feather River may occur with changes in project operations. These changes would occur if there were a substantial alteration of project releases. Resource Actions that modify reservoir water levels would be seasonal changes outside of the range of historical operations.

5.5 MINIMIZATION AND CONSERVATION MEASURES

Over the life of the new FERC license, DWR will implement minimization and conservation measures developed in coordination with USF&WS, to avoid and minimize project-related effects on State or federally listed species and designated critical habitats, and conserve and enhance potential habitat for these species within the FERC Project Boundary. DWR will not implement these measures on land that is withdrawn from the Project Boundary. The goal of the minimization and conservation measures, described below, is to ensure that potential habitats for listed species are not permanently or adversely affected in size or quality at any time. If additional species are listed and occur within the FERC Project Boundary, additional measures may be developed and implemented under separate ESA consultation.

All the measures described below will be implemented under the new FERC license. DWR will seek FERC approval, as necessary, to implement these measures immediately or in accordance with any alternative timeframes stated in the measures, under the current FERC license. DWR will formally request FERC to modify the current FERC license as necessary to immediately implement any of those measures that may be a substantive modification of the current license. Implementation of conservation measures prior to issuance of the new FERC license will be restricted to only those measures that do not involve any potential “take”, as defined by the ESA, of federally listed species or their habitat. Measures that require a take authorization from the USFWS would only by implemented once the USFWS has issued a Programmatic Biological Opinion (PBO) or a BO to FERC for the new license.

The avoidance, minimization and conservation measures for listed species summarized below include measures for the southern bald eagle, giant garter snake, California red-legged frog, and vernal pool wildlife species and valley elderberry longhorn beetle. These measures are to ensure that habitat and potential habitat for federally listed species under the ESA are not permanently adversely affected in size or quality at any

time over the life of the new FERC license (excluding catastrophic events). Implementation of these measures is specifically directed to avoid loss of:

- Individual elderberry plants or elderberry plant vigor
- Aerial extent and/or linear feet of habitat
- Habitat connectivity or patchiness
- Habitat quality due to incompatible uses including high-impact human recreational activity

DWR will operate and manage, to the extent feasible, Wildlife Management Areas (WMA) within the FERC Project Boundary in a fish and wildlife friendly manner, with the needs of fish and wildlife balanced with compatible recreational needs or other competing actions. This will not apply to portions of the WMA that are withdrawn from DWR jurisdiction and/or FERC-designated boundaries.

In order to implement the avoidance, minimization and conservation measures described below and ensure compliance with the terms and conditions of the new FERC License and PBO or BO, a listed-Species Coordinator will be designated. The responsibilities of the listed-Species Coordinator will include:

- Ensure that DWR personnel, CDFG and DPR who operate or manage programs and activities on project area lands are apprised of minimization and conservation measures and their obligations and requirements as well as obligation and requirements of a PBO or BO issued to FERC for the relicensing;
- Employ best efforts to ensure that DWR does not adversely affect listed species or their habitats within the FERC Project Boundaries and at facilities or engage in any take of a federally listed species beyond that is authorized by USFWS under a PBO or BO issued for the FERC relicensing;
- Report any material breach of these conservation measures to USFWS.
- Plan, conduct and chair an annual meeting for all involved agencies, USFWS and others, to discuss progress and problems with appropriate adaptive management changes in implementing minimization and conservation measures, and requirements of a PBO or BO issued to FERC for the relicensing; and
- Provide a written report annually to the USFWS by March 1 detailing the annual meeting and related issues involving implementation of conservation measures and the PBO or BO for the relicensing.

5.5.1 Southern Bald Eagle

The southern bald eagle nests at three sites along Oroville Reservoir. Use of other areas within the FERC Project Boundary is limited. Thus, minimization and conservation measures for this species are focused on Oroville Reservoir proper and on or within 0.25 miles or less of any project feature and include the following:

1) Site specific bald eagle management plans have been prepared and will be implemented for each of the three known active bald eagle nesting territories located on the Oroville Reservoir, in coordination with CDFG and USFWS. The three initial plans will be finalized and implemented at least 3 months before the start of the 2005 bald eagle nesting season for the Crystal Hill, Potter Ravine and Bloomer nesting territories. Discovery of new nesting territories will be disclosed by telephone and in writing to both CDFG and the USFWS within 10 working days. DWR will develop draft site-specific management plans within 30 days for the new territories unless there is an extension based upon consultations with CDFG and the USFWS**.**

2) Foraging conditions around each active bald eagle nesting territory will be enhanced by installing a fish structure in the reservoir within identified foraging areas, as defined by the management plan for the nesting territory. Enhancement will include at least one fishery structural/cover element installed annually. The fishery structure/cover element will be defined and described in the Resource Action for reservoir fishery enhancement.

3) DWR will ensure that the DPR, CDFG, BLM and USFS and other agencies and organizations interested in bald eagle management are advised and invited to the annual listed-species meeting and provided copies of annual reports.

4) DWR will conduct a survey at least every 2 years as part of the State Mid-winter Bald Eagle Count. The focus of the surveys will be the identification of potential management issues on FERC Project Boundary lands relative to wintering bald eagles.

5.5.2 Giant Garter Snake

Habitat for the giant garter snake primarily occurs in the Thermalito Forebay and Thermalito Afterbay and the OWA. Minimization and conservation measures directed toward the giant garter snake are described below for these general areas.

1) The same amount, quality, including connectivity of existing giant garter snake wetlands habitat as defined by DWR's 2004 habitat mapping (Chapter 6.0, Species Accounts and Status in the Action Area) will be maintained along the North and South margins of the Thermalito Forebay, Thermalito Afterbay

including existing waterfowl brood ponds, and within the OWA as identified in the DWR's completed 2004 baseline habitat mapping. DWR will at least annually in writing apprise others involved in activities in the Thermalito Forebay, Thermalito Afterbay and OWA of this requirement.

Small impacts to giant garter snake wetland habitat not exceeding an average annual value listed in Table 5.4-1 will be offset by mitigation as identified in the USF&WS giant garter snake mitigation guidelines. Compensation sites will be within the FERC Project Boundary.

Table 5.4-1. Maximum habitat affected annually.

Area	Wetland Habitat (acres)	Upland Habitat (acres)
North and south Thermalito Forebay margins	>0.10	0.25
Thermalito Afterbay margins	0.50	1.50
Existing waterfowl brood ponds at Thermalito Afterbay and OWA	1.00	2.50
Back-water and/or slough areas (≥0.10 acre) of the main Feather River channel	1.00	-

Small (≤0.10 acre) isolated, backwater and/or slough areas of the main Feather River channel will not be considered giant garter snake habitat nor the flowing portion of the Feather River and therefore as long as activities in these areas do not adversely affect giant garter snake habitat or threaten direct take, no mitigation is required.

2) Prior to initiating any activities in the "D" area of the OWA, such as controlling beavers and/or otherwise changing hydrology of the area in such a way that would significantly affect the quality or extent of the high-value giant garter snake wetlands habitat occurring there, DWR will consult with the USFWS. DWR will apprise others involved in the management of the area of the requirement to consult with the USFWS prior to conducting activities in "D" area that would significantly alter either the quality or extent of the high-value giant garter snake wetlands habitat. Small impacts associated with invasive plant control (aquatic primrose) in the "D" area, where the only means practicable for control is large-scale chemical, mechanical or hydrological manipulation, that results in the temporary loss of giant garter snake cover habitat exceeding 25 percent annually, will be offset in advance by providing replacement cover at or near (<0.50 mile) the treatment site or by consulting with the USFWS before initiating the large scale treatment program. DWR will apprise others involved in activities in the "D" area of this requirement annually and in writing.

3) To the extent possible, activities that disturb, destroy, fragment or otherwise modify habitat (i.e., soil compaction) including activities from construction or maintenance of trails, roads, or other permanent recreational features will be minimized in upland habitat within 200 feet of giant garter snake wetland habitat as defined in DWR 2004 habitat mapping, at the Thermalito Forebay, Thermalito Afterbay including existing waterfowl brood ponds and within the OWA. Futher, all excavation within 200 feet of giant garter snake wetland habitat will be restricted to the snakes active period (April 1 through October 31).

   Small impacts to giant garter snake upland habitat not exceeding the average annual total listed in Table 5.4-1 will be offset by mitigation as identified in the USF&WS giant garter snake mitigation guidelines Compensation sites will be within the FERC Project Boundary. DWR will apprise others involved in activities in upland habitats of this requirement annually and in writing.

   Compensation will not be implemented for short-term, non-permanent impacts associated with management activities implemented for general fish and wildlife enhancement (i.e., crossing uplands with large equipment to install osprey nesting platforms, or with All Terrain Vehicles to access sites for noxious weed and plant control operations).

4) Rodent control activities of any kind will not be conducted by DWR or others in designated giant garter snake wetlands habitat, or within 200 feet of the habitat, except as may be necessary to insure structural intergrity of Dams or for public safety in high visitor use areas including in the immediate vicinities of public swimming lagoons, boat-launching ramps, beach areas, restrooms, picnic areas and related day-use facilities and designated campgrounds. DWR will at least annually apprise others involved in rodent control activities in these areas in writing of this requirement.

5) Non-native or noxious weeds, trees or shrubs that colonize any giant garter snake wetlands habitat, or associated upland habitat within 200 feet of the wetlands habitat will be removed only by hand, using hand tools or through individual plant treatment with appropriate herbicides. Broad spectrum or large-scale chemical or mechanical means that might otherwise adversely affect more extensive areas of the giant garter snake habitat will be prohibited. Non-native or noxious weed removal operations conducted in this restricted manner are considered beneficial to the giant garter snake provided that there are no other obvious direct or indirect adverse effects to the species of its habitat. DWR will at least annually in writing apprise others involved in noxious weed control of this requirement.

   The treatment of large areas of infestation of aquatic weed species, such as water primrose in the “D” area of the OWA, that cannot be effectively controlled except by broad-scale chemical application will be minimized. The

annual, temporary loss of giant garter snake cover due to loss of the habitat will not exceed 25 percent annually unless suitable replacement cover is provided in advance at or near (within <0.50 mile) the treatment site. DWR will consult with the USFWS before proceeding if offsetting replacement cover is not available.

6) Structural components of giant garter snake habitat (i.e., large woody debris [LWD]), that accrue or move through natural processes will not be removed, moved or otherwise altered, except as may be necessary for operation of the project or public safety in the high-visitor-use areas including in the immediate vicinities of the public swimming lagoons, boat-launching ramps, beach areas, restrooms, picnic area and related day-use facilities and designated campgrounds. Since no giant garter snake habitat occurs upstream of Oroville Dam this restriction will not apply in this upstream area. DWR will at least annually in writing apprise others involved in LWD maintenance and removal activities in these areas of this requirement.

7) A continuing public education program will be developed and implemented with a goal of preventing giant garter snakes from being intentionally harmed or killed. At a minimum, this program will consist of appropriate signage, posted and maintained semiannually at the North and South Thermalito Forebay and Thermalito Afterbay including at least one sign at each waterfowl brood pond. The signs will describe the sensitive nature of the giant garter snake and the need to avoid harming the snake. The signs will be posted as necessary, in conjunction with existing signage warning of the hazards in the area due to rattlesnakes.

8) Dog-training field exercises in the Thermalito Afterbay area will be restricted to reduce current and potential impacts to giant garter snake from disturbance and displacement in wetlands and associated uplands habitats. Dog training activity will be limited to a maximum of one-third annually of the aerial extent of the better giant garter snake wetlands habitats and associated uplands that exists around the Thermalito Afterbay. This restriction will apply during the giant garter snake's active periods of the year, April through October. The dog training activities can occur during the giant garter snake's inactive periods from November through March, unless any evidence of the need for further minimization of impacts is documented. DWR will at least annually in writing apprise others involved in dog training activities in the Thermalito Afterbay of this requirement.

9) DWR will maintain and optimally manage high value giant garter snake habitat around the Thermalito Afterbay's margins occurring in the waterfowl brood ponds.

    a. All brood ponds occurring at the time of DWR's 2004 habitat mapping and completion of the programmatic BA will be maintained to ensure

the same quality, acreage and connectivity to nearby habitat and associated uplands.

b. Four new brood ponds totaling about 70 acres will be constructed in the Thermalito Afterbay within the first four years of the new FERC license to compensate and offset potential adverse effects to giant garter snake from Afterbay water-level fluctuations. Construction of additional waterfowl brood ponds above the 70 acres, will be used as advance conservation to offset other adverse impacts to the giant garter snake or its habitat that may occur in the area if it is determined that they will be managed as giant garter snake habitat over the term of the license. All appropriate conservation banking guidance in effect at the time will be followed.

c. Semi-permanent wetlands will be maintained in the brood ponds areas by operating the Thermalito Afterbay or by other methods to achieve a water surface elevation of at least 133.5 feet for at least 12 consecutive hours at least once per month annually during the giant garter snake active period April through October, except as when an individual pond is being drained for management/maintenance actions.

d. Management regimes designed to improve/enhance waterfowl habitat in the waterfowl brood ponds will be conducted that do not affect (1) more than 25 percent of each pond, if only portions of ponds are being drained annually, or (2) 25 percent of all ponds, if whole ponds are being drained annually.

e. DWR will remove as many large (> 6 inches) predatory fish as practical from each waterfowl brood pond at least once every 2 years.

f. Plant control within the waterfowl brood ponds will be limited to using only shallow-dicing in dry areas, except that deep disking may be done during the giant garter snake's active period (April through October).

g. Burning of vegetation in the brood ponds for habitat management will be limited to closely controlled burns only during the giant garter snake's inactive period November through March and limited to a maximum of two brood ponds and associated uplands every 2 weeks during the giant garter snake's active period (April through October).

h. Non-selective burrow fumigant devices will not be used by DWR or others either within the waterfowl brood ponds or within 200 feet of any waterfowl brood pond.

10) Burning of wetland margins and/or disking of unvegetated portions of the Thermalito Afterbay drawdown zone will be restricted to the inactive period

of the year for the giant garter snake (November through March). DWR will at least annually in writing apprise others involved in such activities in the Thermalito Afterbay of this requirement.

11) State agencies will cultivate wildlife food and cover plants grown on uplands around the Thermalito Afterbay in a manner that minimizes potential giant garter snake impacts and apprise others in writing, by the following:

    a. To the extent practicable, limit necessary disking, planting, and cultivation in uplands to periods of giant garter snake activity April through October. This limitation will be particularly important when soil penetration associated with planting is to be relatively deep. When these agricultural activities must be performed during the giant garter snake's inactive period, upland areas within 200 feet potential giant garter snake wetlands habitat with potential giant garter snake burrowing places will be flagged and avoided to the extent practicable.

    b. Planting of forage-and cover- crops in uplands within 200 feet of giant garter snake wetlands habitat will be limited to less than 26 percent annually of all such available habitat around the Thermalito Afterbay edges.

12) DWR's existing gravel mining operations in the OWA in or within 200 feet of giant garter snake habitat will be reviewed by December 31, 2006 and modified as necessary to be more giant garter snake friendly. Potential improvements include reducing steep-edged pond banks, adding cover and structure such as large woody debris, creating benches, increasing edges and irregularities and installing vegetation plantings. Implementation of these improvements for giant garter snake will be conducted during the giant garter snake active period April through October so as not to adversely affect the giant garter snake or its habitat. Such measures when done specifically to benefit the giant garter snake will not be considered adverse effects or take as long as any earth-moving is restricted to the giant garter snake active period (April through October).

13) DWR will encourage State's gravel-mining lessees operating on land within the FERC Project Boundary and in or within 200 feet of giant garter snake habitat to implement habitat improvements such as reducing steep-edged pond banks, adding cover and structure such as large woody debris, creating benches, increasing edges and irregularities and installing vegetation plantings. DWR will provide to the lessees copies of the PBO or BO issued for the project, the BA for the FERC relicensing action and DWR's habitat maps. DWR will provide copies or written reference to these documents to the lessees at least every 5 years.

14) DWR will encourage road-maintenance agencies, including California Department of Transportation and the Butte County Department of Roads and Highways, irrigation districts and private landowners, who maintain culverts, ditches, canals and other wetlands-related structures along and under State Highway 99 along the westerly edge of the Thermalito Afterbay, to avoid altering or degrading and improving, if possible, these structures for use as giant garter snake connectivity habitat. DWR will provide at least once every 5 years to these entities copies of the USFWS PBO or BO as well as DWR's habitat maps and this BA

5.5.3 California Red-Legged Frog

General minimization and conservation measures that DWR will implement for the California red-legged frog include the following:

1) Measures described for the giant garter snake and vernal pool wildlife species will be implemented to protect and conserve potential California red-legged frog habitat for the possible future reintroduction or natural recolonization of this species in habitat within the FERC Project Boundary.

2) Prior to initiation of any formal planning of future proposed action on lands within the FERC Project Boundary upstream of Oroville Dam that would or could affect California red-legged frog habitat, DWR will conduct protocol-level surveys (per USFWS guidelines in effect at the time). If California red-legged frog is detected during these surveys, DWR will consult with the USFWS prior to continuing the planning process for the proposed activity.

5.5.4 Vernal Pool Invertebrates

Vernal pools within the FERC Project Boundary are limited primarily to the vicinity of the Thermalito Afterbay, the North and South Forebays of the Thermalito Forebay and the OWA. Minimization and conservation measures for vernal pools and associated wildlife species will be implemented in these areas and include the following:

1) The same amount and quality including hydrologic connectivity of existing vernal pool habitat presently existing within the FERC Project Boundary (as defined by DWR habitat mapping and in Chapter 6.0) will be maintained. This baseline is 253 individual vernal pools or vernal swales totaling about 18.3 acres. DWR will apprise others involved in management activities near vernal pools of this requirement, at least annually and in writing

    a) Small unavoidable direct and indirect impacts not to exceed an average of 0.50 acres annually (from the date of the issuance of a USFWS PBO or BO to FERC for the relicensing action, to the date of the most recent small impact), and not to exceed 4.0 acres over the life of the FERC license will be compensated for by either: (1) 1:1 creation

area to impacted area (replacement of the whole affected vernal pool area) for direct effects (i.e.. any direct loss of aerial pool extent) if the creation precedes by 6 months or more the impact; (2) 2:1 creation area to impacted area if the creation is done later in time than 6 months before the impact occurs, and (3) 2:1 preservation to impacted area through permanently preserving by purchase, conservation easement or other means otherwise threatened vernal pool habitat for indirect affects. All compensation will be on lands within the FERC Project Boundary. DWR will obtain the consent from USFWS for compensation on non-project lands. DWR also may meet conservation needs up front by using a conservation banking process following appropriate guidelines.

b) Additional guidelines that will be followed for vernal pool compensation are:

(i) Recreation of all vernal pool habitats will be directed at restoring former vernal pool habitats, as determined by historical project-area mapping, and only after these former habitats are fully used or are infeasible for vernal pool creation, will other non-former vernal pool habitats be used upon approval by the USFWS.

(ii) Preservation activities will occur on non-project lands only after DWR has obtained approval from the USFWS in advance when the vernal pool habitat faces one or more demonstrable threats.

(iii) While indirect effects are defined as any substantive effects within 200 feet of a vernal pool, these indirect effects will be considered direct effects if the hydrology of the vernal pool is altered in any way, regardless of the distance to the affected vernal pool.

(iv) Scraping of substrates from non-impacted vernal pools to use as inoculum for vernal pools that are being re-created will be avoided since this action will be an adverse direct effect at the scarping site.

(v) Inocula will be obtained only from vernal pools that will be impacted and that will be compensated for.

(vi) All vernal pool re-creations and preservation actions will follow any standard protocols issued by the USFWS and in effect at the time of the impact to the vernal pool, as determined from the USFWS or its internet site.

c) DWR may choose to meet its compensation requirements for vernal pool habitat through the use of a conservation bank. All appropriate

USFWS conservation banking guidance in effect at the time will apply to the maintenance and use of a conservation bank.

2) All vernal pools identified during DWR habitat mapping (Chapter 6.0) will be surveyed annually in the spring of each year for the first 5 years beginning in 2005, and then in the spring of every other year thereafter over the remaining life of the FERC license. Surveys will be timed just as the vernal pools are drying. The primary objective of the surveys will be to detect and record any adverse effects which may threaten vernal pool habitat including ORV use, broken or cut fences allowing unauthorized access, missing signs, sedimentation, or other factors. Another objective will be to evaluate the implementation of each of the vernal pool minimization and conservation measures. Results of the surveys and the effectiveness of the minimization and conservation measures in preventing disturbance to these habitats will be summarized in a sub-report that will be approved and signed by DWR's Oroville Field Division Chief. This approved sub-report will be included in the annual overall listed-species report.

3) All fences protecting vernal pool from vehicular access or other adverse uses will be inspected at least monthly. Any damaged, vandalized, or degraded fences will be promptly repaired within 30 working days. DWR will apprise others in writing annually of this requirement.

4) Regular patrols and enforcement of existing restrictions by DWR security staff, DPR rangers or CDFG wardens will be encouraged and promoted to reduce recreational-use impacts to vernal pools and associated habitat.

5) Signage indicating restricted vehicular access (e.g., Sensitive or Closed Area-No Vehicular Access-Violators will be Cited) will be posted by October 2004 by DWR or others near vernal pools access points and maintained to reduce recreational-use impacts to vernal pool habitat. Installation of new signage will focus on locations of historical or new problem areas where vehicular access has occurred.

6) All roads that DWR determines are no longer necessary or needed will be abandoned and revegetated by December 2006. This measure will focus on closing any roads that are currently causing siltation problems in nearby vernal pool habitat.

7) Gravel coverings will be applied to all seepage-pump access roads located along the south and west edges of the Thermalito Afterbay by December 2008. Roads causing siltation into vernal pool habitat will be addressed first if this work must be implemented in phases due to budgetary constraints.

8) A sediment-trapping program will be implemented by December 31, 2005 using various measures (e.g., gravel, rock, silt fencing, silt-screening, hay

bales, wattles coconut mats) to reduce and/or prevent sedimentation into vernal pool habitat. Through adaptive management over time, the best management practices will then be selected and routinely (at least annually checked and repaired (implemented, as necessary, over the life of the FERC license. However, erosion control matting in which coconut, straw or other absorbent fibers are wrapped in one or two layers of small-size (<3/4 x 3/4-inch mesh) plastic mesh or nylon netting material will be avoided because these materials are known to entrap and kill snakes. Netting of 3/4 x ¾-inch or larger, which is unlikely to entangle and entrap snakes, may continue to be used in the sediment-trap measures.

9) Earth-moving activities will be conducted in a manner that does not in any way alter the hydrology to the 253 vernal pools and swales identified within the FERC Project Boundary during relicensing studies (Chapter 6.0).

10) Disking for any purpose, including for fire-breaks and general fish and wildlife enhancements will not be conducted any closer than 100 feet from vernal pool edges. DWR will apprise others in writing at least annually of this requirement.

11) Use of any herbicide for weed control and /or fuel control within 200 feet of vernal pools will be avoided to the extent practical. If herbicides must be used as a last resort, acetolactate synthase–inhibiting herbicides will be avoided in favor of glysofate-based products, such as Roundup®. Use of surfactants and emulsifiers, which can of themselves be hazardous to vernal pool species, will be limited to the extent practicable and feasible. Mowing will be the preferred method for weed and fuel control around (within 200 feet) of vernal pools, except if the pools are part of or near (within 200 feet) any giant garter snake habitat. DWR will advise others in writing of the above requirements at least annually.

5.5.5 Valley Elderberry Longhorn Beetle

Habitat for the valley elderberry longhorn beetle occurs throughout the Action Area. Minimization and conservation measures to be implemented for this species include the following:

1) The same amount and quality of valley elderberry longhorn beetle habitat that that now exists within the FERC Project Boundary, based upon DWR's 2004 habitat mapping (Chapter 6.0) will be maintained. Valley elderberry beetle habitat is elderberry shrubs and associated riparian vegetation. Currently 95 acres of elderberry shrubs occur within the FERC Project Boundary and 52 acres of elderberry shrubs occur downstream to the mouth of the Feather River. Elderberry habitat occurs within the OWA, and based upon DWR's Geographic Information System (GIS), there are about 4,800 linear feet (with 25-foot buffers) and 33,100 linear feet (with 100-foot buffer) of roads. Based

upon these numbers, roadside elderberry bushes have developed and are thriving, despite current routine maintenance practices including road grading.

Future direct and indirect impacts to all currently existing elderberry shrubs will be avoided to the maximum extent practical throughout the life of the new FERC license but if this is not possible the following compensation will be implemented:

a) Small unavoidable direct and indirect impacts may occur up to an average of 0.50 acres of elderberry shrub canopy area annually (calculated from the date of issuance of the USFWS PBO or BO to the FERC relicensing action to the date of the most recent small impact), but will not exceed a total of 5.0 acres of elderberry shrub canopy area over the life of the new FERC license. Compensation for these habitat losses will follow the USFWS July 9, 1999 Conservation Guidelines for the Valley Elderberry Longhorn Beetle, or later USFWS superceding guidelines.

b) Road-grading currently conducted on FERC Project Boundary land is a low-impact maintenance activity to valley elderberry beetle. The potential for impacts from grading will be even further reduced and minimized by ensuring that dusting of elderberry shrubs due to grading is limited by using water trucks to moisten grading areas during any grading activity conducted in the vicinity (i.e., the drip-lines of five or more plants within 100 feet of the grading activity on any given day) of elderberry shrubs, and (ii) grading is limited to less than 80 miles of roads graded once annually.

c) Pruning, for maintenance of public safety, of up to 10 elderberry shrubs annually which may be overhanging roadways (or causing other hazards) or otherwise obstructing vehicle operators' views, will be allowed provided that potential take of valley elderberry longhorn beetle is compensated for following Service's 9 July 1999 *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* or subsequent guidelines. Pruning is to be limited to no more than ¾ of the stem length or ½ the crown area on any individual elderberry shrub.

5) DWR may choose to meet its compensation requirements for valley elderberry beetle and elderberry habitat through the use of a conservation banking process. In such a case, all appropriate USFWS conservation banking guidelines in effect at the time will apply to the creation, maintenance, and use of such a conservation bank.

6) Best Management Practices (BMPs) and other protective measures, as necessary, will be routinely implemented to ensure that elderberry plants are

not inadvertently treated with herbicides or otherwise harmed during non-native and noxious plant control operations.

6.0 SPECIES ACCOUNTS AND STATUS IN THE ACTION AREA

The species accounts described in the following section address the biology, ecology, and potentially suitable habitat occurring within the Action Area for threatened and endangered species, candidate species, and species proposed for listing.

The Action Area includes the FERC Project Boundary and, for some species, areas outside the FERC Project Boundary that support species-specific potentially suitable habitat that could be either directly or indirectly affected by the Proposed Action described in Chapter 5.0. Figures showing potentially suitable habitat for each species are included in the species section, except for the Delta smelt, mountain yellow-legged frog, and California tiger salamander. The Action Area for these species is described in the species section.

6.1 THREATENED WILDLIFE SPECIES

6.1.1 Southern Bald Eagle

The USFWS listed the southern bald eagle as an endangered species in March 1967. After a federal status review, the species was down-listed to threatened in 1995 (60 FR 35999). The bald eagle is currently proposed for federal delisting (64 FR 36453). In California, this species is currently State-listed as endangered.

6.1.1.1 Biology and Ecology

Bald eagles currently nest throughout the western United States, including California. Within California, bald eagles historically nested throughout the state near seacoasts, major rivers, and lakes. As of 1999, there were 188 known nesting territories in 58 California counties (up from 28 counties in 1978) (CDFG Website). Although no data have been summarized for more recent years, the upward trend in nesting population appears to be continuing. In northern California, bald eagles are year-round residents (USFWS 1986; pers. comm., M. Perkins 2004). Hundreds of additional bald eagles migrate into California during the winter from nesting territories throughout Washington, Oregon, Alaska, and Canada.

In most of California, the breeding season lasts from about January through July or August (CDFG Website). Females lay between one and three eggs; two is the most common clutch size (Stalmaster 1987). Both the female and male incubate the eggs; incubation typically lasts about 35 days. Both parents bring prey back to the nest to feed the eaglets; one study documented as many as seven items brought to one nest in one day (Stalmaster 1987). Chicks fledge when they are 11 or 12 weeks old. Fledglings disperse from the nest area as early as several weeks after fledging.

Bald eagle nesting territories vary greatly in size. Various estimates include: 0.06 square miles (mi^2) in eastern Canada (Gittens 1968), 0.09 mi^2 in Alaska (Hensel and Troyer 1964), 0.42 mi^2 in Minnesota (Mahaffy 1981), and 0.60 mi^2 in Michigan (Mattsson 1974). The most typical territory size is likely 0.4 to 0.8 mi^2 (Stalmaster

1987). Eagles normally do not build a nest within 0.6 mi of another occupied nest, although there are exceptions. Territory shape can be nearly circular to oval, to almost linear, depending on the configuration of trees and water. Lake Britton in Shasta County has one of the highest known nesting densities, with average distances between territories of 1.5 mi. (Detrich 1980).

Bald eagle habitat can generally be described in terms of nesting and wintering requirements. A third component—foraging habitat—also has some specific attributes that vary geographically and seasonally. The following sections discuss the various habitat requirements, followed by information on known threats to bald eagle habitats and populations.

Nesting Habitat

Bald eagles usually nest in the same territories year after year, but may use alternate nests (as many as five) within the territory. Nesting habitat in California and throughout the Pacific states is described as multi-storied forests with old-growth trees and snags that are near water (Anthony et al. 1982; Zeiner et al. 1990). In a 1979 survey of 95 bald eagle nest sites in northern California, 87 percent were in dominant or co-dominant ponderosa pine or sugar pine (Lehman 1979). Associated stands were generally open (less than 40 percent canopy cover) and within 1 mile of a water body. Approximately one-third of the nest sites were within 0.1 mile of a water body and 85 percent of the nests had an unobstructed view of the water body. Seventy percent of the nests were associated with reservoirs.

The characteristics of actual nest trees varies considerably throughout the species' range. In California and arid portions of Oregon, nest trees averaged 41 to 46 inches diameter at breast height (dbh) (Lehman et al. 1980; Anthony et al. 1982). In addition to requiring stands with large trees for actual nest construction, nesting eagles also require the presence of snags and dead-top trees with large lateral limbs for access, perching, and territory defense (USFWS 1986).

Wintering Habitat

Wintering eagles require diurnal perches and nocturnal roosts. Perches need to be near a food source—usually within 164 feet of water—while roosts can be many miles from the foraging area (Stalmaster 1987). Perches can be natural or man-made, but need to be relatively tall and strong enough to support eagles. Sometimes eagles will perch on lower objects or structures such as fence posts, rocks, or buildings (Stalmaster 1987). Eagles spend 90 percent of the daylight hours perched, either hunting for prey, resting, or eating (Stalmaster 1987).

Roost sites typically provide shelter from cold, wind, and precipitation, and may be used communally or by individual eagles. Preferred roost trees tend to be taller than the surrounding forest or landscape. Roosts are most often conifer stands, but in some areas cottonwoods and willows are used for night roosting (Isaacs and Anthony 1983).

In northern California, several nesting pairs studied by PG&E were found to be year-round residents (pers. comm., Perkins, 2004). In this case, eagles typically roost during the winter within several miles of the nest site (USFWS 1986). Communal roosts can support many eagles and are typically not too far from a rich food source (concentrated waterfowl or fish) (USFWS 1986). Isolation is an important component of winter roosts; therefore, areas near development and human activity are sometimes avoided.

Foraging Habitat

Foraging habitat for bald eagles includes lakes, rivers, oceans, shorelines, and occasionally deserts, grasslands, and alpine (Stalmaster 1987). In northern California, most bald eagles nesting near reservoirs forage on fish; waterfowl are used as well, particularly in the winter (PG&E 2002). Jackman et al. (1999) reported that inland nesting bald eagles prey on native and introduced fish, including brown bullhead (*Ameiurus nebulosus*), Sacramento sucker (*Catostomus occidentalis*), carp (*Cyprinus carpio*), and tui chub (*Gila bicolor*). These authors also report that mallards (*Anas platyrhynchos*) and coots (*Fulica americana*) also are prey in some areas. Many of the fish taken are carrion found by bald eagles in shallow water, on river/lake shores, or downstream of hydroelectric powerhouse tailraces. Fish prey in the upper North Fork Feather River include: carp, bullhead, Sacramento sucker, hardhead squawfish, and tui chub (pers. comm., Perkins 2004). Large concentrations of waterfowl during migration or winter can serve as a rich food source for numerous bald eagles. Mammalian carrion (e.g., voles, ground squirrels, rabbits, deer, and livestock) can be an alternate source of food for eagles in some areas (USFWS 1986). There are no data available on food habits at Lake Oroville; however, it is likely that they forage on fish and supplement their diet with waterfowl. Based upon survey data, waterfowl are not believed to be a significant component of nesting bald eagle diet in the vicinity of the Oroville FERC Project Boundary. Nominal numbers of spring nesting waterfowl occur only in the Foreman Creek area, which is used infrequently by bald eagles from the Potter Ravine territory. Waterfowl may be a significant forage item for wintering bald eagles as DWR biologists have occasionally observed bald eagles taking waterfowl on the Thermalito Afterbay during December, January, and February (pers. comm., Bogener 2004). Large concentrations of waterfowl are present on the Thermalito Afterbay during these winter months. While not directly observed, it is likely that some wintering bald eagles also forage on wintering waterfowl on the Feather River, Diversion Pool, and Thermalito Forebay. However, waterfowl numbers in these areas are substantially lower than those on the Thermalito Afterbay. Numerous observations of wintering bald eagles foraging on coots were recorded in the rice fields immediately west of the Thermalito Afterbay (pers. comm., Bogener 2004).

Threats to Habitat and Populations

Between the 1940s and 1970s, bald eagle populations and reproductive success were depressed, primarily due to the heavy use of the insecticides DDT and DDE that resulted in eggshell thinning (USFWS 1986; Stalmaster 1987). Other reasons for reproduction failure have included desertion of territories, removal of nest trees,

disturbance at the nest, predation on eggs and eaglets, disease, and storms. Primary sources of mortality are indiscriminant killing by shooting; collisions with power lines, towers, automobiles, and aircraft; and electrocution on power lines and poles (USFWS 1986).

Bald eagles can be intolerant of human activity during the breeding season, especially early in the season during courtship and nest building. Human activity can result in nest abandonment and subsequent loss of production (Thelander 1973; Detrich 1980; Bogener 1980; Lehman 1983). However, tolerance for human activity varies from pair to pair, and in some areas eagles nest year after year very close to areas of human activity. Several reservoirs that are used by bald eagles and also extensively used for recreation include Lake Shasta in northern California and Lake Billy Chinook in central Oregon.

6.1.1.2 Recovery Plan

The Pacific States Bald Eagle Recovery Plan (Recovery Plan) (USFWS 1986) outlines the steps needed to recover and maintain bald eagle populations in the Pacific recovery area, which includes California as well as Nevada, Oregon, Washington, Idaho, Wyoming, and Montana. The Recovery Plan provides objectives for providing secure habitat; developing inventory, research, and monitoring; implementing public awareness and law enforcement programs; and reducing bald eagle mortality. Measures for providing secure habitat include protecting existing nest trees and roost sites, maintaining and improving forest habitat, limiting disturbance at eagle use areas, and maintaining food sources.

At the time the Recovery Plan was issued in 1986, bald eagles in California were listed as endangered, with 75 known breeding territories statewide (1985) and an average productivity of 0.94 young per occupied territory (1975 to 1985). As stated in the Recovery Plan, delisting would occur on a region-wide basis when there were a minimum of 800 breeding pairs in the seven state recovery area, an average success rate of 1.0 fledged young per occupied territory, and an average success rate of at least 65 percent per occupied territory over a 5-year period. Between 1990 and 1999, the state average bald eagle production ranged between 0.9 and 1.1 fledglings per occupied nest. The Recovery Plan included target recovery goals for 47 management zones; these targets would need to be met in 80 percent of the zones for delisting to occur (USFWS 1986).

The Oroville FERC Project Boundary is in the Sacramento Valley and Foothills Management Zone (Zone 27); in 1985 there were four known territories in Zone 27, including one in the Lake Oroville area. The target recovery goal for Zone 27 was 15 nesting territories, including 4 in the Lake Oroville area (USFWS 1986). Primary identified threats to the species for the zone included loss of anadromous fishery, loss of riparian habitat, disturbance to forage areas, and shooting (USFWS 1986). Key recovery tasks included the following:

- Prohibiting logging of known nest trees, perch trees, and winter roost trees;
- Reducing mortality associated with shooting and trapping; and
- Restricting use of poison detrimental to eagles in predator and rodent control programs within important nesting and wintering habitat (USFWS 1986).

The bald eagle was reclassified from endangered to threatened in 1995 (60 FR 35999-36010) throughout its range in the lower 48 states, including California. The species was petitioned for delisting in July 1999 (64 FR 36453-36464). Delisting goals for number of territories, productivity, and breeding success rates were met or exceeded for six of the seven states in the Pacific Recovery Zone, including California, by or before 1999. However, the Recovery Plan goal for distribution by management zone was not met by 1999. Based on information provided by the CDFG for 1997, it appears that target recovery goals have not been achieved in Zone 27 or the Lake Oroville area (CDFG Website).

6.1.1.3 Habitat in the Action Area

This section describes the bald eagle habitat within the Action Area and provides a summary of the studies conducted in this area by the DWR.

Habitat Types and Use Patterns

The Action Area provides both nesting and wintering habitat for the bald eagle, as described below. Only one bald eagle nesting territory—Potter Ravine—is completely within the FERC Project Boundary; the other two territories border Lake Oroville but extend for a considerable distance beyond the boundary. An overview map of bald eagle nest territories is presented in Figure 6.1-1. Figures 6.1-1a, 6.1-1b and 6.1-1c show the Potter Ravine, Crystal Hill, and Bloomer bald eagle nesting habitats within the Action Area.

Nesting Habitat

Bald eagle nest sites in the FERC Project Boundary are located in ponderosa pine (*Pinus ponderosa*) and foothill pine (*P. sabiniana*) woodlands that have relatively large trees with broken tops or other deformities (Table 6.1-1).

Table 6.1-1. Bald eagle nest site characteristics.

Nesting Territory	Distance from Lake (feet)	Habitat	Nest Tree Species	Nest Tree dbh (inches)	Nest Tree height (feet)
Potter Ravine	1,000	PIPO/PISA	PIPO	36	70-80
Crystal Hill	1,050	PIPO/PISA	PIPO	41	150
Bloomer	100	PIPO/PISA/ARME	PIPO	43	100-120

PIPO=Pinus ponderosa, PISA=Pinus sabiniana, ARME=Arbutus menziesii

Winter Habitat

Winter bald eagle survey data indicate that Lake Oroville receives extensive wintering use by both adult and immature eagles (21 total). Survey data suggest that Lake Oroville is the principal wintering area within the FERC Project Boundary with about 90 per cent of the observed use associated with the lake. Relatively minor bald eagle winter use occurs at other aquatic habitats within the FERC Project Boundary, with few sightings recorded at Diversion Pool, Thermalito Forebay and Thermalito Afterbay, Low-flow Reach, High-flow Reach, and the Oroville Wildlife Area dredger ponds. No communal winter roosts are known to occur in the Action Area. It is likely that wintering eagles make use of the forested habitats for night roosts, although they may fly to areas outside of the Action Area as well.

Primary foraging areas documented during surveys conducted in 2002 and 2003 include Potter Ravine, Spillway Cove, Foreman Creek, the lake within 1 mile of the dam, and Diversion Pool, Middle Fork Arm, McCabe Creek on the South Fork Arm, Sycamore Creek, Kennedy Ravine, and Bloomer Cove.

Figure 6.1-1. Bald Eagle Nest Territory Locations

Due to the confidential nature of the content of this section of the BA, this information is not included.

Figure 6.1-1a. Potter Ravine Bald Eagle Nesting Territory.

Due to the confidential nature of the content of this section of the BA, this information is not included.

Figure 6.1-1b. Crystal Hill Bald Eagle Nesting Territory.

Due to the confidential nature of the content of this section of the BA, this information is not included.

Figure 6.1-1c. Bloomer Nest Bald Eagle Nesting Territory.

Due to the confidential nature of the content of this section of the BA, this information is not included.

Habitat Designation

The FERC Project Boundary lies within the Bald Eagle Recovery Zone 27, as identified in the Recovery Plan (USFWS 1986). The Recovery Plan does not designate any critical habitat for bald eagles.

Habitat Quantity and Quality

The three existing bald eagle nesting territories in the Action Area are located in similar pine woodland habitat. DWR has developed bald eagle management plans for all three territories (DWR 2004a, b, and c) (Appendix B). Potential alternate or replacement nest trees are limited within the Potter Ravine and Bloomer nest territories. The plans also report that high fire fuel loading presents a risk to nest stands. Current levels of recreational use and livestock grazing do not appear to be affecting habitat conditions for resident eagles.

Based on vegetation cover type mapping completed by DWR (2003) for the 173,500-acre study area for the Oroville FERC Project Boundary and 1-mile buffer, there are approximately 6,300 acres of Montane Hardwood-Conifer forest that have trees with an average dbh of at least 24 inches. Only about 943 acres of this habitat are within the FERC Project Boundary. The 6,300 acres represent slightly less than 4 percent of the entire study area.

There are no site-specific data on the diet of bald eagles that use Lake Oroville. However, based on data from other sites in northern California, it appears that the lake supports large populations of potential prey fish species.

6.1.1.4 Survey Methods and Results for the Action Area

A number of bald eagle surveys were conducted in the Action Area in 2002 and 2003. Methods and results of these surveys are summarized in the following sections.

Methods

The 2002 and 2003 breeding season surveys were conducted by DWR on Lake Oroville, Diversion Pool, Thermalito Forebay, Thermalito Afterbay, and along the Feather River within the Action Area. Surveys were primarily boat-based, but both foot- and vehicle-based surveys were used in some areas. The surveys involved inspection of potentially suitable trees for nests, observation, mapping of areas where adult eagles were present, and following adult eagles to locate nests and foraging areas. Repeated visits to areas of regular bald eagle activity occurred whether or not a nest had been identified. All active nest territories were visited at least once per month during the breeding season. A January 2003 midwinter bald eagle census was conducted within the FERC Project Boundary in coordination with the statewide effort on the same date.

Results

At least five bald eagle nest territories have been historically documented within the Action Area. Of these five, three territories were occupied (at least one adult bald eagle was present during the breeding season) during both the 2002 and 2003 breeding seasons (Table 6.1-2). No bald eagle nests were detected along the Feather River downstream of Lake Oroville.

All three occupied nest territories were near the Lake Oroville shoreline; the two historical territories were abandoned. Plumas National Forest, California Department of Parks and Recreation, and BLM manage the lands occupied by these territories and monitor nest occupancy and success. During 2002, all three of the nest territories had a pair of adult bald eagles present on the nest tree during February and were thus classified as occupied (Stalmaster 1987; Jurek 1990). One territory was active (incubation behavior observed) in 2002 and produced two fledglings; this territory was unknown prior to 2002. Two territories, including the productive territory from 2002, were active in 2003, and produced a total of four young. No incubation behavior was detected during either survey year at the non-active but occupied territories. However, adult bald eagles were observed sporadically within the vicinity of these territories throughout the breeding season.

Table 6.1-2. Bald eagle production within the Action Area during 2002 and 2003.

Category	2002	2003
Number of occupied territories	3	3
Number of active territories	1	2
Fledglings/occupied territory	0.7	1.3
Fledglings/active territory	2.0	2.0

The three territories produced 0.66 fledglings per occupied nest and 2.0 per active nest in 2002. During 2003, 1.3 young were produced per occupied nest and 2.0 per active nest. Between 1990 and 1997, only three fledglings were documented from nest territories within the Action Area (Jurek 1997). Between 1988 and 2001, 14 nest territories in the Upper North Fork Feather River drainage (Lake Almanor to Belden Powerhouse) upstream of Lake Oroville fledged an average of 1.0 young per occupied nest (PG&E 2002). Between 1990 and 1999, the state average bald eagle production ranged between 0.9 and 1.1 fledglings per occupied nest (CDFG Website).

Several bald eagle nest territories were established along the Sacramento River below Lake Shasta in the last decade. Survey crews evaluated potential bald eagle nesting habitat along the lower Feather River downstream of Lake Oroville during the course of the bank swallow population surveys, but did not observe any large stick nests or adult bald eagles.

Winter bald eagle survey data indicate that up to 21 adult and immature eagles at a time use Lake Oroville. Relatively minor bald eagle winter use was recorded at other aquatic habitats within the project boundary.

6.1.2 Giant Garter Snake

6.1.2.1 Biology and Ecology

The giant garter snake (*Thamnophis gigas*) is the largest garter snake native to California (Stebbins 1985), reaching a length of about 5 feet and weighing up to 1.0 to 1.5 pounds. This species is endemic to wetlands in the Central Valley of California that include the Sacramento Valley in the north and the San Joaquin Valley in the south (Miller and Hornaday 1999). The giant garter snake occurred historically from Butte County southward to Buena Vista Lake in Kern County. Currently, there are 13 recognized populations of giant garter snake found in the Sacramento Valley and isolated portions of the San Joaquin Valley (Miller and Hornaday 1999).

The giant garter snake inhabits marshes, sloughs, ponds, small lakes; low gradient streams, and other waterways; agricultural wetlands such as irrigation and drainage canals and rice fields; and the associated adjacent uplands (USFWS 1997). There are four essential components to giant garter snake habitat: (1) adequate water during the snake's active period, spring through mid-fall; (2) emergent, herbaceous wetland vegetation, such as cattails and bulrushes for escape cover and foraging habitat; (3) upland habitat for basking, cover, and retreat sites; and (4) higher elevation uplands for cover and refuge from flood waters (Hansen and Brodie 1980). Gently sloping banks vegetated with upland vegetation that extend 20 to 30 feet inland are an important habitat element, as they provide escape, cover protection, and rodent burrows as refugia. Giant garter snakes also utilize rodent burrows, soil cracks, and rock crevices for refuge, overwintering, and to escape high summer temperatures. The giant garter snake has been documented using burrows and riprap as wintering sites (USGS 2003). While overwintering sites are generally located above high water levels, giant garter snakes will also use lower elevation areas (USFWS 1997).

Giant garter snakes are most active from early spring through mid-fall. They emerge from wintering sites in April and begin returning to winter sites in October, with most snakes underground by November (USGS 2003). Giant garter snakes feed primarily on aquatic prey such as mosquito fish (*Gambusia affinis*) that are confined to small pools (Hansen 1980; Brode and Hansen 1992) and amphibians. They generally forage within the water body but use open areas in upland habitats along the shore for basking. The predominant food items of giant garter snakes are introduced species such as carp (*Cyprinus carpio*), mosquito fish, and bullfrogs (*Rana catesbeiana*) (Miller and Hornaday 1999).

Primary predators of giant garter snakes include bullfrogs, largemouth bass, catfish, and predatory birds such as herons and egrets. Less important predators include raccoons, coyotes, skunks, and hawks (USFWS 1997).

The daily activity of giant garter snakes as described by Hansen and Brode (1980) follows a general pattern: (1) emergence from burrows after sunrise; (2) basking to warm bodies to activity temperatures, particularly during cool weather or on cold mornings; and (3) foraging or courting activity for the remainder of the day. Giant garter snakes are usually active during the day but may forage during early evening hours on warm days (USGS 2003). Giant garter snakes usually remain in close proximity to wetland habitats but have been found as far away as 860 feet from the edge of marsh habitat in burrows during the winter and 164 feet from the edge of marsh habitat in burrows in summer. This species has also been recorded moving up to 5 miles in a few days in response to dewatering of habitat due to refuge maintenance of water control structures. Median home ranges documented in 1995 to 1997 in the Central Valley varied as follows:

- In Gilsizer Slough within the Sutter Basin (south of the Oroville facilities) from 0.8 to 259.5 acres;
- In Colusa NWR within the Colusa Basin from 1.3 to 1,120 acres; and
- Badger Creek within the Cosumnes Preserve south of Sacramento from 4.2 to 82.0 acres (Miller and Hornaday 1999).

The breeding season for the giant garter snake begins soon after emergence from the hibernacula and lasts from March into May. Females bear 10 to 25 approximately 8.5-inch long live young in the late summer (late July through early September) (Hansen and Hansen 1990). Young immediately disperse upon birth. Sexual maturity is reached in about five years in females and three years in males. Growth is variable, but young typically double their size during the first year.

Changes in land use practices and other human-related actions are responsible for the decline of this species. Specifically, the following land uses have negatively affected the giant garter snake habitat and populations (Thelander 1994):

- Conversion of upland and wetland habitats to urban development;
- Alteration of waterways and streams for agriculture;
- Watershed alteration and flood control resulting in elimination of historic floodplains and associated wetlands; and
- Livestock grazing resulting in loss of riparian and emergent vegetation, water pollution, trampling, altered plant community compositions and population dynamics.

Additional population impacts occur due to increased road kills at roads adjacent to occupied habitats. Introduction of sunfishes and bass (collectively termed centrarchids), crayfish, bullfrogs and other non-native predators have rendered many areas of

potentially suitable habitat as unusable for this species. Reliance on agricultural areas for habitat raises concerns about long-term stability and suitability of the area as habitat as well as concerns about direct chemical contamination affecting snake health. Indirect effects, such as altered food availability and predator-prey relationships, also may affect the long-term viability of some extant populations (Hansen 1980).

The historical range of the species extended southward from Sacramento and Contra Costa counties to near Bakersfield (Fitch 1941). Brode and Hansen (1992) and Hanson (1980) have indicated that by the 1950s it had been extirpated from the lower one-third of its distributional range and was also extirpated from wetlands in Kings and Tulare counties. Its range during the 1970s and 1980s is believed to extend from near Burrel in Fresno County (Brode and Hansen 1992) northward to the vicinity of Chico in Butte County (Rossman and Stewart 1987). According to Hansen (1980), giant garter snake distribution is associated with areas of rice-based agriculture in Butte, Colusa, Glenn, Sacramento, and Sutter counties, and counties along the eastern margins of the Sacramento and San Joaquin delta from the Laguna Creek-Elk Grove region of central Sacramento County south to Stockton. It is also present in western Yolo County in the Yolo Bypass area. Within this range, 13 distinct population groups or clusters are recognized; however, several large towns and cities (including Chico, Yuba, Sacramento, Galt, Stockton, Guistine, and Los Banos) are expanding and could jeopardize large areas of additional habitat (Goude 2001). The giant garter snake is still presumed to occur in 11 counties: Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo (Miller and Hornaday 1999).

Giant garter snake sightings are recorded throughout Butte County in the vicinity of the Oroville Facilities and FERC Project Boundary (Action Area) including the following: Gridley, Pennington, Upper Butte Basin, Howard Slough, Butte City and Llano Seco (Miller and Hornaday 1999). One sighting was reported within 2 miles of the FERC Project Boundary in the California Natural Diversity Database (CNDDB) along Riceton Road, 1.6 miles south of Highway 162 south of Richvale, approximately 2 miles east of the Thermalito Afterbay and 4 miles west of the OWA (CDFG 2004). In addition, unconfirmed sightings have been reported by DWR (2003a) in the past near Robinson's Pond, adjacent to the Action Area, and in the Cherokee Canal near Richvale, approximately 2 miles west of the Thermalito Afterbay.

6.1.2.2 Recovery Plan

The giant garter snake was federally listed as threatened on October 20, 1993 (58 FR 54053). The FWS issued a Draft Recovery Plan for the giant garter snake on July 2, 1999 (Miller and Hornaday 1999), but has not finalized the plan. Additionally, conservation guidelines specifying protective measures were updated in 1999 (USFWS 1999).

There are four recovery units in the Central Valley: the Sacramento Valley, Mid-Valley, San Joaquin Valley, and South Valley units. The Butte Basin, Colusa Basin, and Sutter Basin lie within the Sacramento Valley Recovery Unit. The Oroville Project Facilities and Action Area lie to the east of this recovery unit. Within the Sacramento Valley

Recovery Unit, the giant garter snake relies on rice fields and managed marsh areas in wildlife preserves or managed areas. Miller and Hornaday (1999) indicate that giant garter snakes are numerous in rice growing areas. This is attributed to a diverse array of habitat elements occurring in rice cultivation, including rice fields, water marshes, ditches, drains, canals, and levees, which provide habitat structure and complexity.

The recovery objective for this species is to delist the giant garter snake. A subpopulation will be considered viable when it contains both adults and young. The recovery criteria include the following:

- Attainment of both adult and young in 90 percent of the subpopulations in the four recovery units in 17 of 20 years as indicated by monitoring results.
- Protection of all extant populations within the recovery unit from threats that limit populations.
- Support of habitat within the recovery unit through adaptive management and monitoring.
- Ensuring that subpopulations are well connected by corridors of suitable habitat.
- Successful repatriation at a specified number of suitable sites.

The actions needed for recovery include the following:

- Protecting existing populations and habitat.
- Restoring populations in areas formerly inhabited.
- Surveying to determine species distributions.
- Monitoring populations.
- Conducting necessary research including: demographics, population genetics and habitat use; and
- Developing and implementing incentive programs and an outreach and education plan.

6.1.2.3 Habitat In the Action Area

There are potentially suitable habitat areas for giant garter snakes within the Action Area, which is the area within the FERC Project Boundary (Stevens and Murphy 2002), including the Thermalito Forebay, Thermalito Afterbay, the Oroville Wildlife Area, and certain limited areas along the Feather River. Potentially suitable habitat also occurs in adjacent irrigation and drainage canals and rice fields outside the Action Area.

However, the species was not found during relicensing studies in 2002 and 2003 in any of areas within the Action Area.

Habitat Quantity and Quality

Although there are areas within the Oroville FERC Project Boundary that have potentially suitable giant garter snake habitat, quality and suitability for the species is significantly compromised, as discussed below. Figures 6.1-4a, 6.1-4b and 6.1-4c show areas of potentially suitable giant garter snake habitat within the Oroville FERC Project Boundary, including areas of the Thermalito Forebay (Figure 6.1-4c), Thermalito Afterbay, and OWA. Approximately 4,280.9 acres of potential habitat (including freshwater emergent wetlands and, ponds) occur within the FERC Project Boundary (DWR 2003b). In addition, rice cultivation occurs adjacent to the Thermalito Afterbay and OWA, which also provides potential suitable habitat. Sightings of the giant garter snake (CDFG 2004) have been recorded in the rice fields west of the Thermalito Afterbay. Rice cultivation is the dominate land use west of the Thermalito Afterbay (Figures 6.1-4a and 6.1-4b) and includes rice fields, ditches, drains, and levees. The Main Ditch, Main Canal, and Biggs Extension (which is connected to the Main Canal), supply water to the rice fields to the west of the Thermalito Afterbay and terminate within about 500 feet of the western edge of the Thermalito Afterbay (Figure 6.1-4a), potentially providing connectivity for dispersal between the habitats associated with rice cultivation and potential suitable habitats in the Thermalito Afterbay. In addition, culverts under Highway 99 provide potential connectivity to the Thermalito Afterbay and adjacent rice fields. The Hamilton Slough connects the Biggs Extension, and Lateral and Main Canals to the Feather River west of the OWA and south of the outfall of the Thermalito Afterbay (Figure 6.1-4a). Agriculture including orchards and rice fields are the principal land uses west of the OWA (Figure 6.1-4a). The Hamilton Slough connects the Biggs Canal and the Lateral and Main Extensions to the Feather River immediately south of the Thermalito Afterbay outfall and west of the OWA, and potentially provides connectivity of the rice cultivation areas to the OWA.

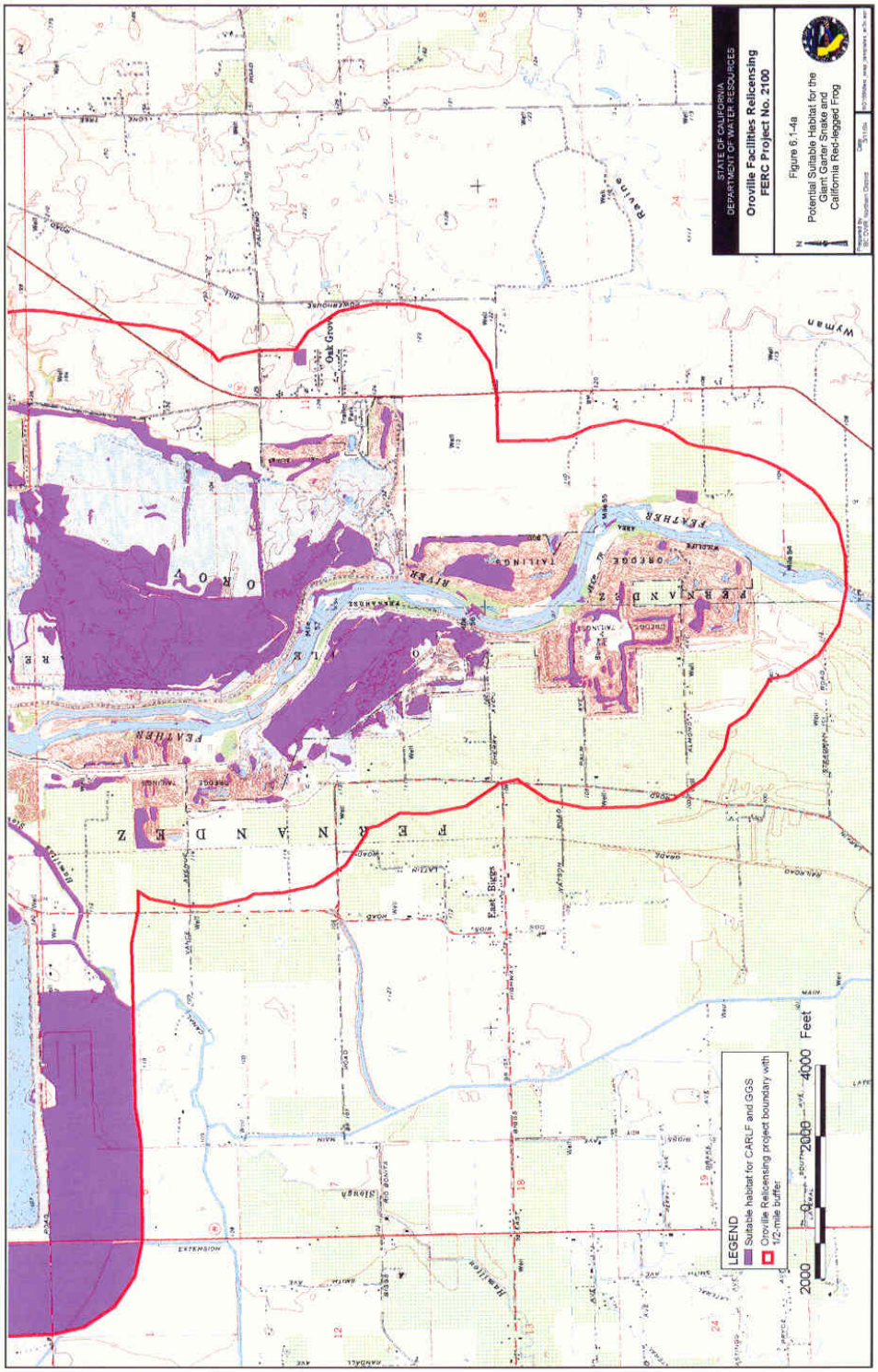

Figure 6.1-4a. Potential Suitable Habitat for the Giant Garter Snake and California Red-Legged Frog.

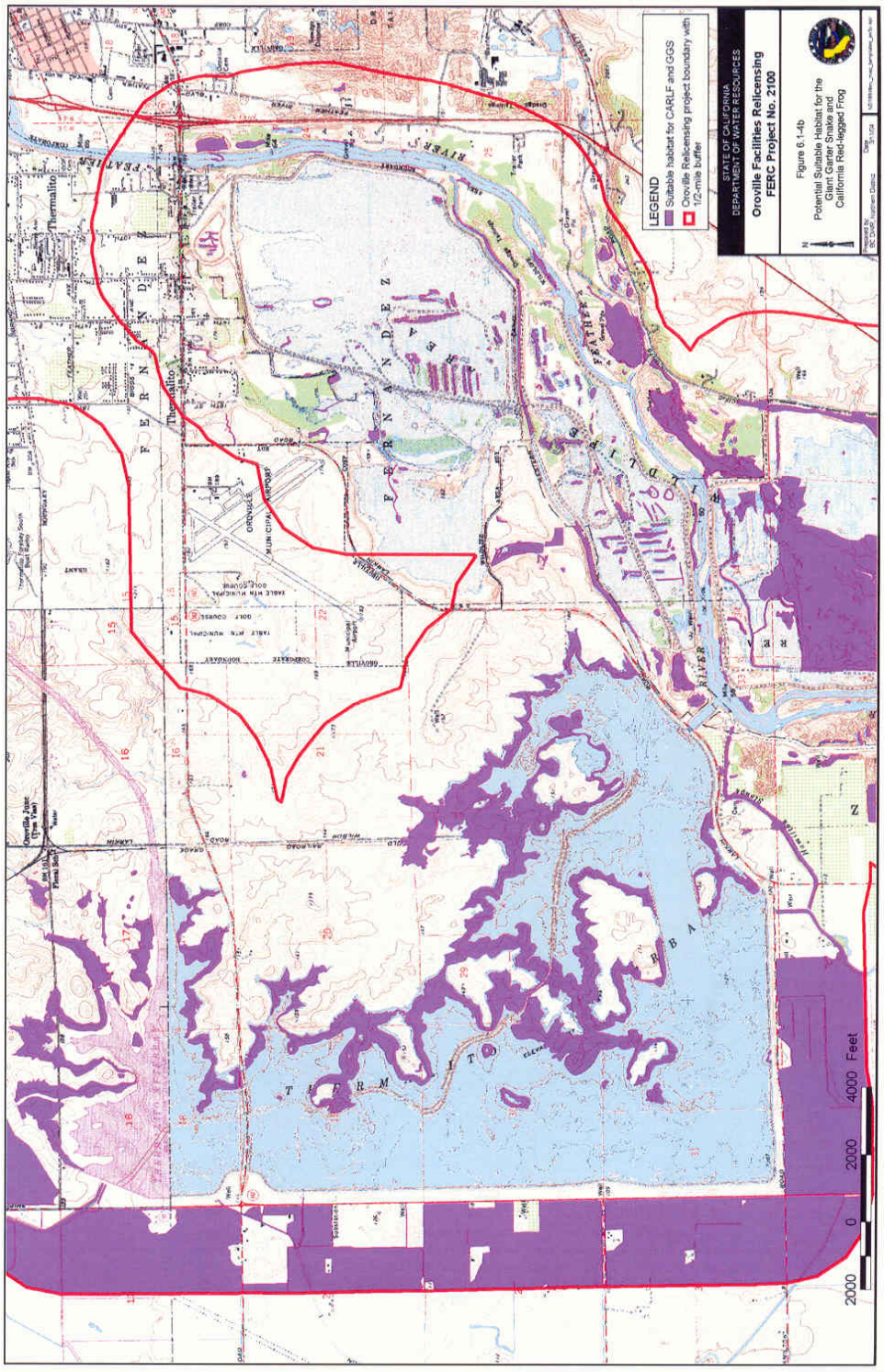

Figure 6.1-4b. Potential Suitable Habitat for the Giant Garter Snake and California Red-Legged Frog.

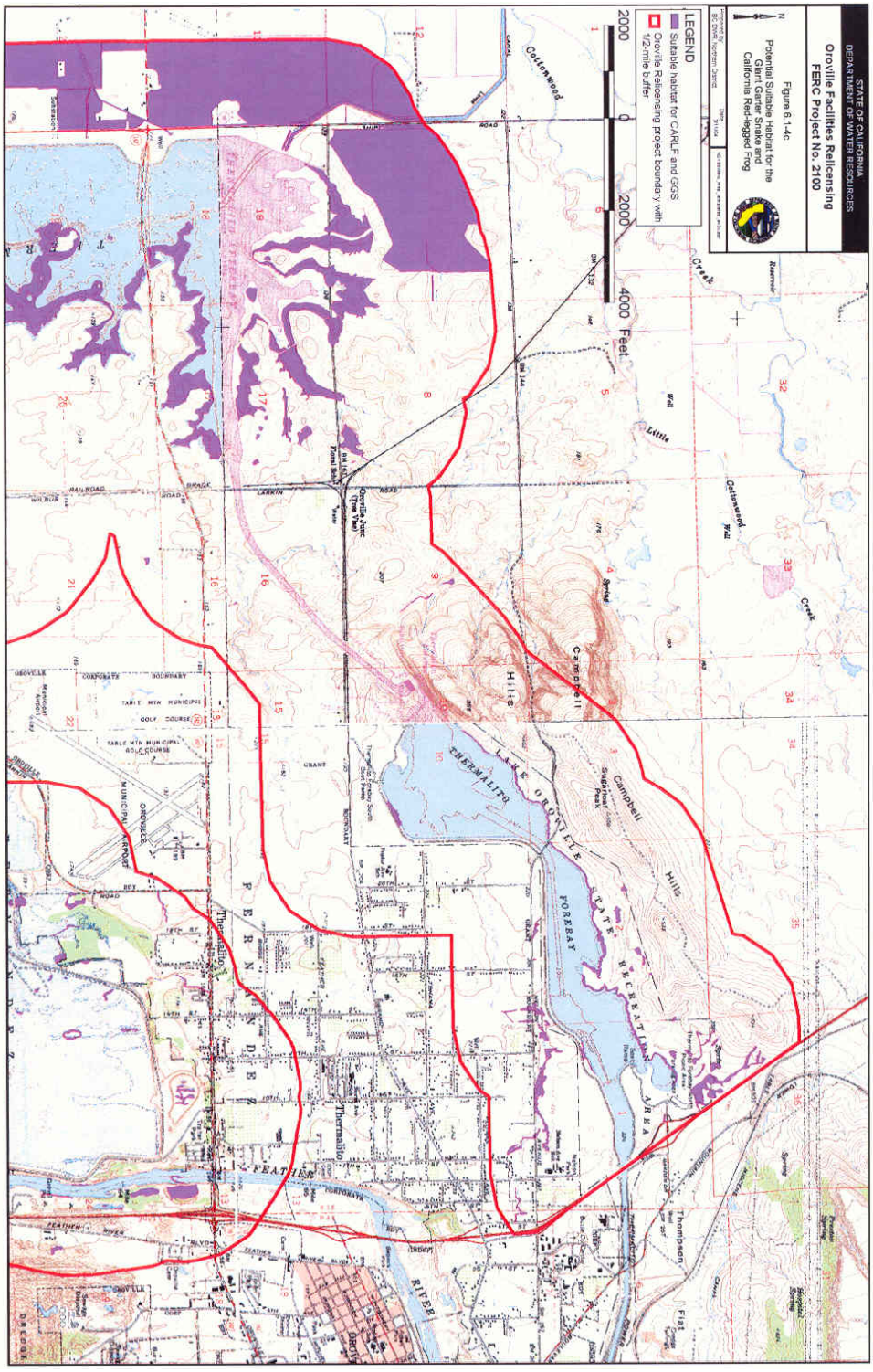

Figure 6.1-4c Potential Suitable Habitat for the Giant Garter Snake and California Red-Legged Frog.

Potentially suitable habitat in the Thermalito Afterbay exists where large stands of emergent vegetation such as *Typha* or *Scirpus* are present near the shoreline but where the shoreline offers open, exposed areas suitable for basking. Adjacent to these areas are upland habitats that have rodent burrows that can serve as refugia for escape. These habitats may also contribute to the food supply. Islands of emergent vegetation within the water body may serve as suitable habitat. These conditions are present along portions of the Thermalito Forebay. Within the OWA, there are a number of ponds and connecting waterways that offer the combination of emergent vegetation and exposed shorelines with low to moderate grade that lead to suitable upland habitats. Most of the ponds and waterways in the OWA have varying degrees of aquatic primrose cover. In several ponds, the emergent vegetation is surrounded by primrose.

Approximately 20 acres of potentially suitable habitat (about 16,675.9 linear feet of shoreline and uplands) lie on the eastern edges of the Thermalito Forebay. Emergent vegetation and shallow water along the eastern edges, as well as adjacent uplands, provide escape cover, foraging, and basking sites. However, due to the recreation pressures from boating ramps, picnic areas, and fishing in these areas, habitat quality is considered marginal. The eastern edge of the Thermalito Forebay, which consists of relatively steep riprap edges with little or no emergent vegetation or adjacent uplands that can be used for cover, foraging, basking and escape, is not considered potential suitable habitat.

Habitat conditions in the Thermalito Afterbay are similar to that in the Thermalito Forebay. Much of the western edge is man-made rock embankments and lacks emergent and riparian vegetation and adjacent uplands. Also, water levels in the Thermalito Afterbay are subject to high fluctuations. The eastern shore and a portion of the northeastern shore (approximately 76,724.3 linear feet) provide potentially suitable habitat. In addition, five brood ponds located in the eastern portion of the Thermalito Afterbay also provide potential suitable habitat (Figure 6.1-4b). These ponds support emergent and aquatic vegetation and have relatively stable water levels and adjacent upland habitat.

The OWA, as well as the surrounding adjacent rice fields, could potentially provide habitat for giant garter snakes. The most recent documented sighting within the last 10 years near the Thermalito Afterbay and OWA was about 1993 in the Cherokee Canal near Richvale, 2 miles west of the Thermalito Afterbay and more than 5 miles west of the OWA. Further, undocumentated sightings were made by DWR biologists (DWR 2003a) about 3 years ago near Robinson's Pond adjacent to the eastern side of the Feather River, and about 10 years ago within the Thermalito Afterbay (DWR 2003a). Potential dispersal habitat (rice irrigation ditches and canals) connects the OWA with the adjacent rice fields (Figures 6.1-4a and 6.1-4b).

Within the OWA, potentially suitable habitat generally has high surface concentrations of non-native emergent and submergent vegetation such as Eurasian milfoil (*Myriophyllum spicatum*) and the native aquatic primrose (*Ludwigia poploides*). The giant garter snake requires, as one of its recognized habitat components, emergent

vegetation that provides escape cover from predators. The dominance of the primrose raises questions about whether it has a positive or negative effect on giant garter snake habitat. The dense primrose may not meet the needs for emergent/escape vegetation component. The emergent vegetation most often described in literature as an important habitat element for the giant garter snake consists of rushes, reeds, and cattails. The protection offered by rushes, reeds, and cattails is due to their density, both beneath and above the waterline, and vertical height above the water such that typical predators cannot penetrate it to reach escaping giant garter snakes. Recent information from the USGS (pers. comm., Wylie 2004; USGS Website) indicates that aquatic primrose was found to provide suitable escape cover and foraging during field studies and at certain sites is used extensively by giant garter snakes.

For the most part, the Feather River within the FERC Project Boundary does not present potentially suitable giant garter snake habitat, as water is fast flowing and banks are too densely populated with riparian vegetation. In areas along the Feather River where potentially suitable habitat conditions are present, the areas are too small in area, too isolated, or generally have high recreational use, making the sites poor quality for giant garter snake viable population groups.

6.1.2.4 Survey Methods and Results for the Action Area

Methods

Surveys for the giant garter snake habitat were conducted within portions of the FERC Project Boundary to evaluate potentially suitable habitat and document occurrences. Initial habitat delineation was developed using existing GIS project habitat maps. Areas with four essential habitat components were identified as areas for targeted habitat surveys (DWR 2003a). These essential giant garter snake habitat elements (Miller and Hornaday 1999) include: (1) adequate water during the snake's active period (spring thorough mid-fall); (2) suitable cover and foraging habitat of emergent, herbaceous vegetation, such as cattails and bulrushes; (3) basking, cover, and retreat upland habitat; and (4) refuge from flood waters of higher elevation upland vegetation with sufficient cover.

Both pedestrian- and canoe-based field surveys were conducted during the weeks of August 6 and 19, 2002. Visual surveys were performed through all wetland areas defined as containing the four essential components within 1 mile of the FERC Project Boundary. Wetlands located on private lands (outside the FERC Project Boundary) where access was not granted were surveyed using binoculars and a spotting scope. The perimeter of Lake Oroville was surveyed via a small motorized fishing boat (DWR 2003a).

Results

Survey results indicate that there are a number of areas of potentially suitable habitat around the Thermalito Forebay and Thermalito Afterbay, adjacent canals, and within the OWA (Section 6.1.2.3). No sightings were made during relicensing studies.

Much of the area along the northern and western edge of the Thermalito Forebay (Figure 6.1-4c) has relatively shallow water and the banks support ecotones of upland and riparian vegetation. There are isolated areas of open banks suitable for basking. Rodent burrows are abundant in the area and would provide refugia. The Thermalito Afterbay provides large areas of emergent vegetation and open shorelines (Figures 6.1-4a and 6.1-4b). The shoreline exposure varies considerably with water level fluctuations due to project operations. In some areas, the upland vegetation is comprised of grasslands, and dicots of similar physiognomic structure, while other areas have a mix of grasses, shrubs, and trees.

Potentially suitable habitat in the OWA is quite different from that which exists at the Thermalito Forebay and Thermalito Afterbay. There are many ponds within the OWA, but most do not have suitable habitat conditions as emergent vegetation is not present and banks are steep and devoid of vegetation. However, there are a number of ponds and connecting waterways that provide potentially suitable habitat. In these water bodies, pond banks are relatively gently sloped, there are stands of emergent cattails, and open banks lead to upland habitats. In most of the ponds and in the interconnecting waterway, aquatic primrose is prominent. In certain ponds it surrounds the stands of emergent cattails and reeds and extends into the water body.

There has been of some debate as to whether the presence of aquatic primrose in aquatic habitats enhances or detracts from giant garter snake habitat conditions as well as that of other species. Recent field survey observations of giant garter snake, some with radio telemetry, have shown that the giant garter snake does readily utilize the aquatic primrose where it is present and it may in fact offer suitable refugia (per. comm. Wiley, 2004). Some areas lacking cattails and rushes but having other typical habitat characteristics for giant garter snakes may be suitable if aquatic primrose is present.

Many of the ponds exhibiting potentially suitable habitat are interconnected with waterways. These waterways provide aquatic conditions at least part of the year when they could serve as dispersal habitats, but during the drier seasons, some of them become dry with limited aquatic vegetation.

The typical riverine habitat conditions along the Feather River where the water is fast moving, banks are steep or vertical, and riparian vegetation is dominated by dense stands of cottonwoods and willows, is not typical of giant garter snake habitat. However, there are areas of potentially suitable habitat along the Feather River, particularly where backwater areas and side channels exist. In these settings, water is slow moving or quiet, banks are gently sloped and upland vegetation is present. Some of the backwater areas along the river also have aquatic primrose.

The areas that offer the best combination of habitat factors for the species include the wetland habitat along the northern and eastern edges of the Thermalito Forebay near the recreation development, including boating ramps, picnic and fishing access areas, areas on the eastern edge of the Thermalito Afterbay and brood ponds, and “One Mile Pond” in the OWA. These areas support well-developed stands of emergent vegetation

and gently sloping shoreline banks with upland vegetation (DWR 2003a). Due to heavy recreational pressures in the areas of the Thermalito Forebay described above and predatory bullfrogs and fishes discussed below, these are probably not optimal habitats for these species.

6.1.3 California Red-Legged Frog

6.1.3.1 Biology and Ecology

The California red-legged frog (*Rana aurora draytonii*) is the largest native California frog. Adults range from 1.5 to 5.4 inches in length, and females are larger than males.

Historically, the California red-legged frog inhabited suitable habitat from coastal Marin County, near Point Reyes National Seashore, to northwestern Baja California. From the coast, it extended inland to near Redding in Shasta County and was documented in 46 counties (Jennings and Hayes 1985). Currently, the California red-legged frog is considered to be extirpated from 24 of these 46 counties. It is currently known from isolated areas in the Sierra Nevada, northern Coast and northern Transverse Range, and is nearly extinct in the southern Transverse Range and Peninsular ranges (USFWS 2002). The species is now common only along the central coast, in the San Francisco Bay area, and in Baja California.

California red-legged frogs occur in a variety of permanent aquatic habitats including quiet pools of streams, ponds, marshes, and riparian habitats generally from sea level to 3,500 feet msl (USFWS 2002). Essential habitat elements include permanent aquatic habitat associated with uplands and dispersal habitat connecting aquatic habitat (USFWS 2001). Emergent vegetation such as cattails, sedges, and bulrushes, and upland areas are also needed (USFWS 2001). California red-legged frogs show variations in habitat use, either using a pond suitable for all life stages or using multiple habitat types to complete life stages. Populations are thought to persist where there are multiple breeding areas within habitat that can be used for dispersal (USFWS 2002).

Adult frogs may take refuge during dry periods in rodent holes or leaf litter in riparian habitats. The adults have been shown to move over upland habitats for distances of more than 1 mile during wet seasons. Monitored individuals in Santa Cruz County moved more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger 1988 in USFWS 2002). During dry periods, however, the adults are rarely found far from water.

Larval California red-legged frogs are thought to graze on algae (USFWS 2002). Adult California red-legged frogs have a varied diet that includes both invertebrates and vertebrates. Invertebrates comprise the majority of the dietary items; however, vertebrates comprise more than half of the dietary mass (Hayes and Tennant 1985), and include such species as Pacific chorus frogs (*Pseudacris regilla*) and California mice (*Peromyscus californicus*). California red-legged frogs forage within the riparian habitat along water bodies and from the water surface. Juveniles feed diurnally and nocturnally while adults typically forage at night.

California red-legged frogs breed from November through March (Storer 1925) in lowland streams and wetlands, and water impoundments, including livestock ponds (Stebbins 1985; USFWS 2002). Water impoundments, including livestock ponds, are also known to support California red-legged frog breeding. Hayes and Jennings (1988) report that the frog breeds in a variety of aquatic conditions including creeks, ponds, marshes, and lagoons. An important factor influencing the suitability of aquatic breeding sites is the lack of introduced aquatic predators (USFWS 2002). Breeding adults are generally associated with ponds and streams where water is over 2 feet deep and slow moving and emergent and/or riparian vegetation is dense. However, adults have been observed in aquatic conditions where such vegetation conditions were not present. Adult frogs have been observed in tributary streams with pools less than 18 inches deep and, during summer, in pools that averaged 12 inches in depth (USFWS 2002). However, streams with deep pools and dense riparian shading are more commonly the preferred California red-legged frog habitat than are ponds (Hayes and Jennings, 1988). Hayes and Jennings (1988) also state that California red-legged frogs were also most frequently recorded at sites influenced by a small drainage area, having a low local gradient, and in streams having a low stream order.

Male California red-legged frogs reach sexual maturity in two years while females require three years (Jennings and Hayes 1985). The California red-legged frog breeds from November to May (Storer 1925). Males typically arrive at breeding sites about two weeks before the females. The males are vocal during this period. When the females arrive, a male and female assume amplexus and move to a breeding site where oviposition takes place. Egg masses typically have 2,000 to 5,000 eggs and are attached to emergent vegetation (brace) or similar suitable features. California red-legged frogs typically lay eggs attached to emergent vegetation such that the egg masses float at or just below the water surface (Storer 1925).

Depending on water temperature, eggs hatch within 14 days. Egg predation has been observed (Rathbun 1988); however, Schmeider and Nauman (1994) have reported that egg mass jelly contains properties that act as a defense against predation. Tadpoles metamorphose into adults within 75 to 120 days; however, overwintering of tadpoles has been reported (USFWS 2002). Predation on tadpoles is high, particularly soon after eggs have hatched, as they exhibit relatively no movement and do not feed during this period (Schmeider and Nauman 1994).

Historical records show that the California red-legged frog occurred below 5,200 feet in elevation; current records show the frog to be found below 3,500 feet (USFWS 2002). The California red-legged frog has been extirpated from about 70 percent of its known historical range and the majority of large and stable populations occur in coastal drainages of the Central Valley. It historically occurred in 46 counties, but has been extirpated from 24 of them. Specifically applicable to the Oroville Facilities and Action Area, the California red-legged frog was known to occur in habitat along the Feather River in the vicinity of what is now Lake Oroville. The species is now known to occur north of Oroville Lake in Butte County and east of Oroville Lake in Yuba and Plumas counties.

Sightings of the species have been made in a number of locations in Butte County (CDFG 2004). Most of the locations have been north and east of the Action Area in Plumas National Forest (e.g., South Fork Feather River, Berry Creek, and Lassen National Park). Two recent sightings are recorded within 2 miles of the FERC Project Boundary within the Action Area (CDFG 2004). The nearest known location of California red-legged frogs to the Action Area is French Creek drainage pond (CDFG 2004) approximately 1 mile from the Oroville FERC Project Boundary. The other sighting in 1999 is recorded for Hughes Pond at the headwaters of Jack Creek in Plumas National Forest in a spring-fed pond in a meadow dominated by introduced grasses and surrounded by pine forest (CDFG 2004).

The historical and current ranges of the California red-legged frog have been, and continue to be, significantly reduced due to a variety of human-related activities such as urban development, habitat conversions, agricultural development, cattle grazing and dairy farming, channalization and flood control, mining, water impoundment development and water management, recreation, timber harvesting, and introduction of non-native plants and predators and pesticides (USFWS 2002). The amount of upwind agricultural land use and wind-borne chemicals may be an important factor in the decline of the California red-legged frog in California (Davidson et al. 2001).

6.1.3.2 Recovery Plan

The California red-legged frog was federally listed as threatened on June 24, 1996 (67 FR 57830-57831). It is categorized as 6C, a subspecies with a high degree of threat and low recovery potential (USFWS 2002). The final Recovery Plan for the California red-legged frog was issued on May 28, 2003 (USFWS 2002).

The Oroville Project is not located within any of the eight recovery units identified in the Recovery Plan. The closest such unit is the Sierra Nevada Foothills and Central Valley Recovery Unit, which is several miles north of the Oroville Project Boundary. Threats to the recovery of the California red-legged frog include agriculture, livestock grazing, mining, non-native species, recreation, timber harvesting, urbanization, and water management. The estimated potential for recovery in the nearest recovery unit is categorized as low due to the number of limited populations, high level of threats, and medium habitat suitability (USFWS 2002).

The recovery objective for the California red-legged frog is to reduce threats to the species and its habitat and improve its population status sufficiently to warrant delisting.

The species will be considered recovered when:

- Suitable habitat in core areas are protected and managed for the species and the ecological integrity of its habitat is no longer threatened;

- Existing populations of the frog throughout its range are stable;

- Populations in different geographical areas are stable such that a threat to any part of its range would not threatened the species as a whole;

- Introduced and/or new populations are successful in each core area of its historic range where it is currently absent; and/or

- Habitat areas that can serve as corridors of connectivity are identified, protected and managed such that re-colonization via population dispersal is accomplished.

6.1.3.3 Habitat in the Action Area

Potentially suitable habitat for the California red-legged frog, including freshwater emergent wetlands and riparian habitat, occurs within the Action Area, the area within the FERC Project Boundary (Figures 6.1-4a, 6.1-4b and 6.1-4c). Approximately 4,280.9 acres of potentially suitable habitat lie within the Thermalito Forebay, Thermalito Afterbay, OWA, and along the Feather River (DWR 2003b). However, due to factors discussed below, the California red-legged frog is unlikely to currently be utilizing this habitat.

Habitat Types and Use Patterns

Although there is potentially suitable habitat throughout the Action Area (Figures 6.1-4a, 6.1-4b and 6.1-4c), several factors contribute to the absence of this species. There are limited sites that provide all habitat components that can be utilized, such as those for basking and/or cover. Several areas within the Action Area have one or more of the necessary habitat components, but lack others. The eastern edge of the Thermalito Forebay and western edge of the Thermalito Afterbay consist of riprap with little or no emergent vegetation that can be used for cover and shoreline feeding. The western edge of the Thermalito Forebay and eastern edge of the Thermalito Afterbay support suitable emergent vegetation, but have recreational pressures from boating ramps, picnic areas and fishing. The large populations of fish species in the reservoir are recognized as California red-legged frog predators, which reduces habitat suitability.

The OWA, while providing several possible habitat sites, has areas of extensive overgrowth of aquatic primrose, which limits California red-legged frog habitat. Virtually all areas of potentially suitable California red-legged frog habitat within the Action Area have established populations of predatory fish, crayfish, and bullfrogs.

Habitat Designations

The FERC Project Boundary occurs adjacent to the Sierra Nevada Foothills and Central Valley Recovery Unit (USFWS 2002; USFWS Website). Within this recovery core area, the North Fork Feather River, East Branch North Fork Feather, and Middle Fork Feather River watersheds are designated critical habitat.

Habitat Quantity and Quality

Within the FERC Project Boundary Action Area, the 4,280.9 acres of potentially suitable habitat are currently not of sufficient quality to support the California red-legged frog due to the large populations of predators, including bullfrogs and predatory fish, and the presence of non-native aquatic weeds. While physical components of suitable habitat may be present, such as water depth, basking sites, and emergent vegetation, the presence of well-developed populations of non-native predators, such as centrarchids, crayfish, and bullfrogs, limits or eliminates suitability of such areas. Additionally, due to the dense populations of crayfish and bullfrogs, there are high population densities of native predators such as herons and egrets.

This combination of high-density populations of native and non-native predators is likely to significantly limit or prevent successful natural colonization establishment of the California red-legged frog. Some studies have found that bullfrogs and red-legged frogs can coexist (Cook 1998), indicating that introduced predators do not always exclude red-legged frogs from a site. However, in the long-term, the presence of such predators likely does contribute to the decline in populations.

6.1.3.4 Survey Methods and Results for the Action Area

Methods

Habitat suitability surveys were conducted in potentially suitable habitats during the weeks of August 6 and 19, 2002. Prior to the field surveys, potentially suitable habitats were identified on GIS maps of the FERC Project Boundary by delineating wetland areas. Both pedestrian- and canoe-based field surveys were employed to assess potentially suitable habitat. Canoe surveys were conducted in areas not accessible by foot or vehicle. Where access was not possible to potential habitats, including private lands outside of the Project Area, habitat observations were made with binoculars and a spotting scope. The surveys focused on identifying potentially suitable habitat for the California red-legged frog. A formal survey form used by the Service for aquatic and California red-legged frog surveys was used to log site details and habitat characteristics (DWR 2003a).

Results

No California red-legged frogs were observed during the habitat surveys in 2002 or during other relicensing field data collection activities (DWR 2003a). In assessing potentially suitable habitat for the California red-legged frog within the FERC Project Boundary, habitat factors discussed above were evaluated in the field. Potentially suitable habitats that meet all habitat requirements and also are devoid of non-native macro-invertebrate and vertebrate predators are considered suitable for California red-legged frog.

While there are a number of areas of potentially suitable habitat around the Thermalito Forebay, Thermalito Afterbay, and within the OWA, dense populations of non-native

crayfish and other predators, such as bass and bullfrogs, reduce habitat suitability of all areas for California red-legged frogs. Due to the high populations of predatory species throughout the wetland areas within the FERC Project Boundary, it is unlikely California red-legged frogs are currently associated with these habitats.

Unless the non-native predatory species can be removed from the habitat areas described above and the habitats remain protected from future establishment of these predator species, it is unlikely that sustainable California red-legged frog populations will naturally colonize these areas.

6.1.4 Delta Smelt

6.1.4.1 Biology and Ecology

Delta smelt (*Hypomesus transpacificus*) are endemic to the upper Sacramento-San Joaquin River estuary and occur primarily in open surface waters of Suisun Bay, in the Sacramento River Delta upstream to Isleton, and in the San Joaquin River Delta downstream of the Mossdale sampling station (59 FR 65256). Delta smelt are small (usually less than 3.5 inches long) and live for about one year.

The Delta smelt population generally is concentrated in the Suisun Bay estuary west of the confluence of the Sacramento and San Joaquin Rivers in high-outflow years and further upstream in the Delta in low-outflow years (Sweetnam and Stevens 1993). Delta smelt is a euryhaline species (tolerant of a wide salinity range) that spawns in freshwater and has been collected in estuarine waters of up to 14 grams per liter (grams per liter is equivalent to parts per thousand [ppt]) salinity (Moyle, et al. 1992; 59 FR 65256). This species is associated with the freshwater edge (salinity about 2 ppt) of the entrapment zone (a highly productive area where saltwater and freshwater meet) for a large portion of its life span (Ganssle 1966; Moyle et al. 1992; Sweetnam and Stevens 1993; 59 FR 65256).

The proportion of the Delta smelt population found in Suisun Bay during summer and fall is correlated with Delta outflow volume. Delta outflow determines the location of the salinity gradient and may strongly influence Delta smelt distribution. USFWS data indicate that Delta smelt are found in the Bay-Delta estuary where salinity is generally less than 2 ppt. Smelt are rarely found in estuarine waters with salinity of more than 10 to 12 ppt. Except when spawning in freshwater, Delta smelt are most frequently caught in, or slightly upstream of, the entrapment zone where salinity is between 0.5 ppt and 5.2 ppt (State Water Resources Control Board and USACE 1995).

Delta smelt disperse widely into freshwater in late fall and winter as the spawning period approaches, moving as far upstream as Mossdale on the San Joaquin River and up to the confluence of the American River with the Sacramento River, approximately 20 miles downstream of the Action Area (SWRCB and USACE 1995). However, in most years, Delta smelt spawn primarily in the upper end of Suisun Bay, in Montezuma Slough, and in the lower and central Delta. In the Delta, the smelt spawn primarily in the Sacramento River channel and adjacent sloughs (59 FR 852). Shortly before

spawning, adult Delta smelt migrate upstream from the brackish water mixing zone to disperse into river channels and tidally-influenced backwater sloughs (56 FR 65256). Spawning occurs between February and June and appears to occur in dead-end sloughs and shallow edge waters of the channels in the upper Delta and in the Sacramento River above Rio Vista (59 FR 852). Ideal spawning areas are those with moderate to fast flows (including both fluvial and tidal currents) that support an abundance of aquatic vegetation (SWRCB and USACE 1995). Delta smelt spawn at one year of age, and most adults die after spawning. A female Delta smelt deposits approximately 1,200 to 2,600 demersal (sinking) adhesive eggs on substrates such as rock, gravel, tree roots, large woody debris, and submerged vegetation. After the eggs hatch (in approximately 12 to 14 days), larvae float to the surface and are carried by the currents. Under natural flow conditions, the larvae are carried downstream to near the entrapment zone (SWRCB and USACE 1995). Delta smelt feed primarily on plankton but also eat small aquatic insect larvae when available.

The distribution of spawning Delta smelt may depend on outflow. Delta smelt spawn in freshwater and the distribution of freshwater in the Delta is determined by the outflow of the Sacramento and San Joaquin rivers. In years of high outflow, freshwater in the Suisun Bay may encourage Delta smelt spawning in Suisun Bay. Low outflow years may force adult Delta smelt to migrate into the Delta to find freshwater (Wang and Brown 1993).

Delta smelt populations have fluctuated greatly in the past. Their short lives and relatively low fecundity make populations susceptible to depression following periods when conditions are unfavorable, such as during droughts. The Delta smelt population fell to very low levels in the early 1980s. The declines have been attributed to reductions in Delta outflow in some years, excessively high outflow in other years, entrainment losses to water diversions, changes in food organisms, toxic substances, loss of genetic integrity, and habitat destruction (particularly loss of shallow-water habitat) (Moyle et al. 1992).

6.1.4.2 Recovery Plan

The USFWS released a Recovery Plan for Sacramento-San Joaquin River Delta Native Fishes on January 26, 1996 (USWFS 1996) that included Delta smelt. The recovery plan lists the major reasons for the decrease in the number of Delta smelt, in order of importance, as reduction in outflows, entrainment losses to water diversions, high outflows, changes in food organisms, toxic substances, disease (including competition and predation), and reduced genetic variability (USFWS 1996). Modification of habitat is the single biggest reason for listing Delta smelt because both the Suisun Marsh and Delta have been altered by reductions in outflow caused by increased diversion of flowing freshwater, which also results in entrainment losses in the pumps.

The recovery plan lists primary constituent elements essential to the conservation of the Delta smelt as physical habitat, water, river flow, and appropriate salinity concentrations. These elements are required to maintain spawning, larval and juvenile transport, rearing, and adult migration (USFWS 1996). Delta smelt will be considered

restored when population dynamics and distribution patterns within the estuary are similar to those that existed in the 1967 to 1981 period. This period was chosen because it includes the earliest continuous data on Delta smelt abundances and was a period in which populations stayed reasonably high in most years (USFWS 1996).

6.1.4.3 Habitat in the Action Area

Delta smelt do not occur within the Action Area. In studies conducted by the CDFG, DWR, and the Bureau of Reclamation, larval and juvenile Delta smelt were collected from Roe Island in Suisun Bay north to the confluence of the Sacramento and American rivers (59 FR 65256).

6.1.4.4 Survey Methods and Results for the Action Area

Analyses of distribution data indicate that delta smelt do not occur in the action area. No additional surveys were conducted.

6.1.5 Valley Elderberry Longhorn Beetle

6.1.5.1 Biology and Ecology

The valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) is endemic to California, occurring throughout the Sacramento Valley to Shasta County (pers. comm., McGriff 2004) and lower San Joaquin Valley in riparian forest habitats (Barr 1991). This species is specific to its host plant, the elderberry (*Sambucus* sp.), which is common within riparian habitats and adjacent upland habitats in the Central Valley of California. Historically, the valley elderberry longhorn beetle ranged throughout the Central Valley of California. However, recent surveys show that the valley elderberry longhorn beetle occurs only in scattered locations along the Sacramento, American, San Joaquin, Kings, Kaweah, and Tule rivers and their tributaries (Barr 1991).

Little is known about the life history of the valley elderberry longhorn beetle and its ecological requirements except that it is associated with elderberry (Sambucus sp.) throughout its entire life cycle. Collection records indicate that adult beetles may be found from mid-March until early June and emergence is synchronized with the flowering period of the elderberry host. Eggs are deposited in cracks and crevices of the bark of a living elderberry plant and hatch shortly after they are laid (Barr 1991). The larvae tunnel into the soft core of elderberry stems, excavating passages in the wood as they feed. Larvae may remain in this stage for as long as two years before they emerge as adults. While larvae feed on the pith and roots of the elderberry bushes and trees (USFWS 1984), adults are thought to feed on the foliage and flowers (USFWS Website). Suitable habitat is defined as any elderberry shrub that has stems that are 1 inch or greater in diameter at the ground level (USFWS Website; USFWS 1999).

Population densities of the beetle are naturally low (USFWS 1984). It has been suggested, based on the spatial distribution of occupied shrubs, that the beetle is a poor

disperser (Barr 1991). The age and quality of individual elderberry shrubs and trees and stands as a food plant may also be a factor in the beetle's limited distribution. These factors may cause the beetle to be vulnerable to the negative effects of isolation of small populations due to habitat fragmentation (USFWS 1996). Based on current knowledge of the beetle and its habitat, it appears that density of elderberry stands as well as density and diversity of riparian cohorts are indicative of relative habitat quality.

During the past 150 years, over 90 percent of the riparian habitat in California has been destroyed by agricultural and urban development (USFWS 1984). Loss of riparian forests and habitat of the host elderberry shrub have been the main reason for the decline of the valley elderberry longhorn beetle. In the northern half of its geographic range, the valley elderberry longhorn beetle occurs in drainages that appear to function as distinct, relatively isolated metapopulations (Collinge et al. 2001). Under ideal conditions, riparian forests consist of several canopy layers including the following: Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), willows (*Salix* spp.), valley oak (*Quercus lobata*), box elder (*Alnus negundo)*, Oregon ash (*Fraxinus latifolia*), elderberry (*Sambucus* spp.), wild grape (*Vitus* sp.), poison oak (*Toxicodendron diversilobum*), Dutchman's pipe vine (*Aristolochia* sp.), and wild clematis (*Clematis* sp.). Canopy layers at sites of recent valley elderberry longhorn beetle collections include at least some, if not all, of the above trees. Museum records indicate that the beetle has been collected in four central California counties: Merced, Sacramento, Solano, and Yolo (USFWS 1984). Other primary threats to survival of the beetle include loss and alteration of habitat by agricultural conversion; inappropriate grazing; levee construction, stream and river channelization; removal of riparian vegetation and riprapping of riverine shoreline; nonnative animals such as the Argentine ant; and recreational, industrial, and urban development.

6.1.5.2 Recovery Plan

The valley elderberry longhorn beetle was listed as a threatened species on August 8, 1980 (45 FR 52803). The final Recovery Plan for the valley elderberry longhorn beetle was issued on June 28, 1984 (USFWS 1984).

The recovery goals for the valley elderberry longhorn beetle include the following:

- Protection of habitat to prevent degradation at known sites; and
- Protection of newly discovered valley elderberry longhorn beetle habitat along the American, Sacramento, Feather, Tuolumne, Stanislaus, Mokelumne, Calaveras, Cosumnes, and San Joaquin rivers.

The specific needs specified within the Recovery Plan to meet the recovery goals include the following:

- Conduct surveys of the beetle's food plant for presence of the valley elderberry longhorn beetle;

- Develop and implement habitat protection plans to protect known sites as well as newly discovered localities;

- Restore known sites and newly discovered sites including removal of exotic species; and

- Implement protective measures consisting of minimizing the use of herbicides and insecticides, preventing removal of riparian vegetation, and preventing placement of riprap in habitat sites.

6.1.5.3 Habitat in the Action Area

Potentially suitable habitat for the valley elderberry beetle occurs within the Action Area. Figures 6.1-5 and 6.1-5a to 6.1-5o show the locations of potentially suitable habitat within the FERC Project Boundary. A large number of elderberry bushes are found throughout the FERC Project Boundary and along levees in the OWA, as well as along the Feather River. The USFWS observed several old exit holes in dead wood of elderberry shrubs at six sites surveyed scattered throughout the OWA (Barr 1991) (CDFG 2004).

Habitat Designation

Critical habitat for the valley elderberry beetle does not occur in the Action Area. The closest designated critical habitat is located in the Sacramento Valley, more than 20 miles south of the Oroville FERC Project Boundary.

Habitat Quantity and Quality

About 52.115 acres of potentially suitable elderberry shrub habitat occur downstream of the FERC Project Boundary to the confluence of the Feather River with the Sacramento River (Figure 6.1-4a, 6.1-4b to 6.-14g) (DWR 2003b).

Approximately 95 acres of elderberry shrubs (based on mapping each elderberry shrub plus a 25-foot buffer) have been delineated within the FERC Project Boundary (DWR 2003b) (Figures 6.1-4 and 6.1-4g to 6.1-4o). This includes 0.402 acres around Lake Oroville, 2.255 acres in the area downstream from the Oroville Dam and north of Highway 162, and 91.831 acres in the OWA south of Highway 162 and Larkin Road.

The quality of habitat for elderberry shrubs is variable within the Action Area in terms of density. Relatively dense stands of elderberry bush habitat are present in areas along the Feather River and within the OWA.

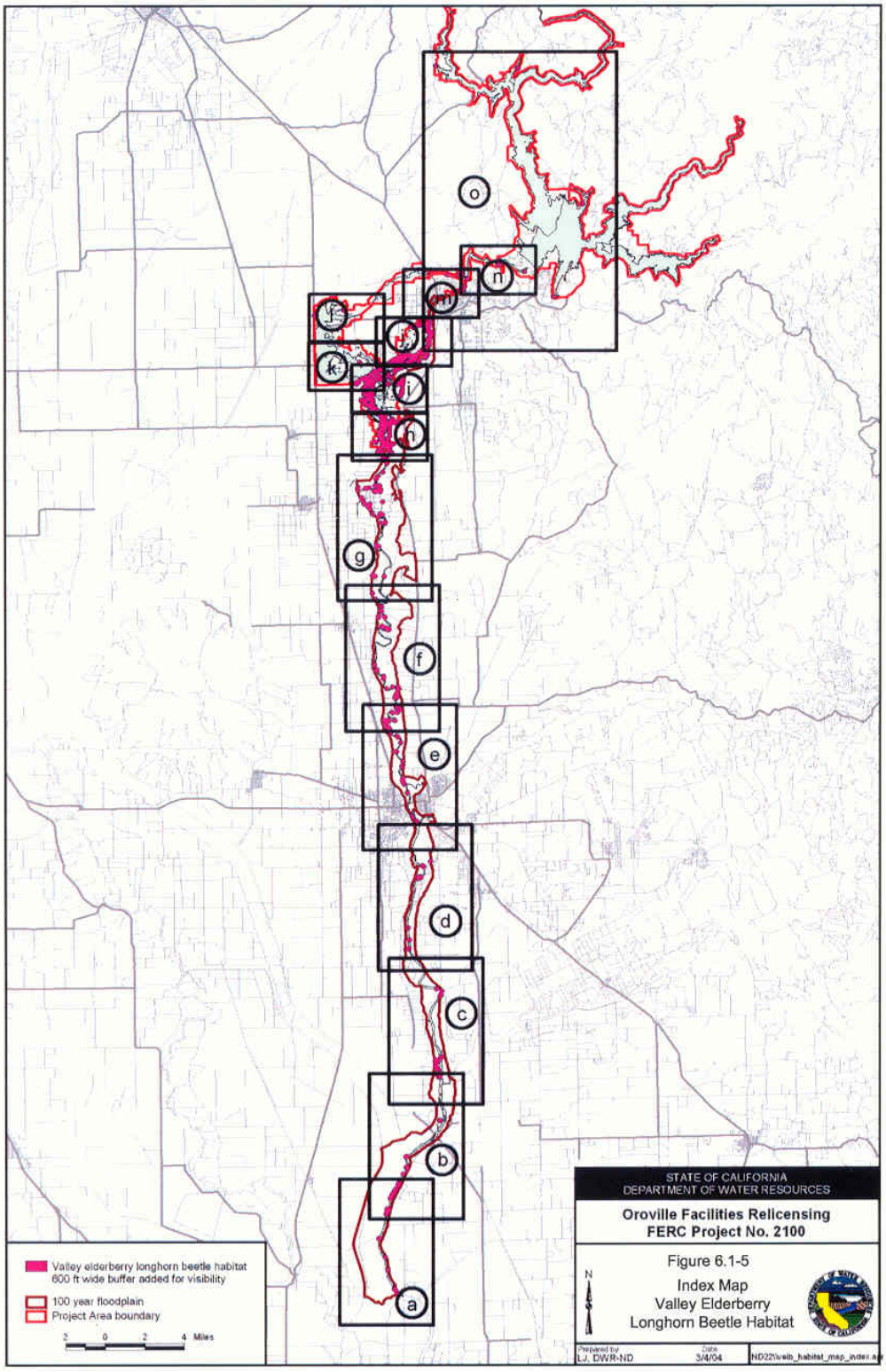

Figure 6.1-5 Index Map Valley Elderberry Longhorn Beetle Habitat.

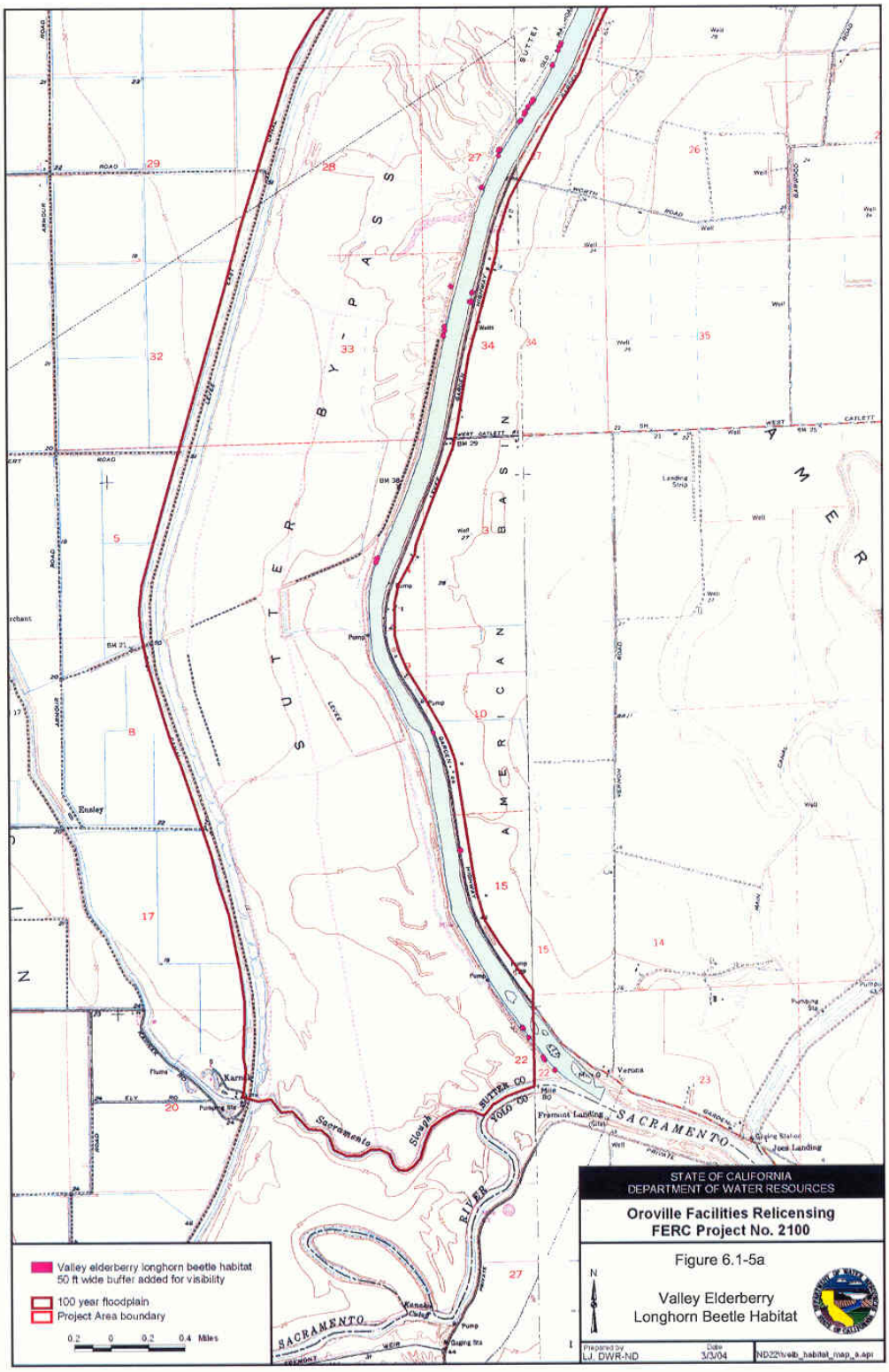

Figure 6.1-5a Valley Elderberry Longhorn Beetle Habitat.

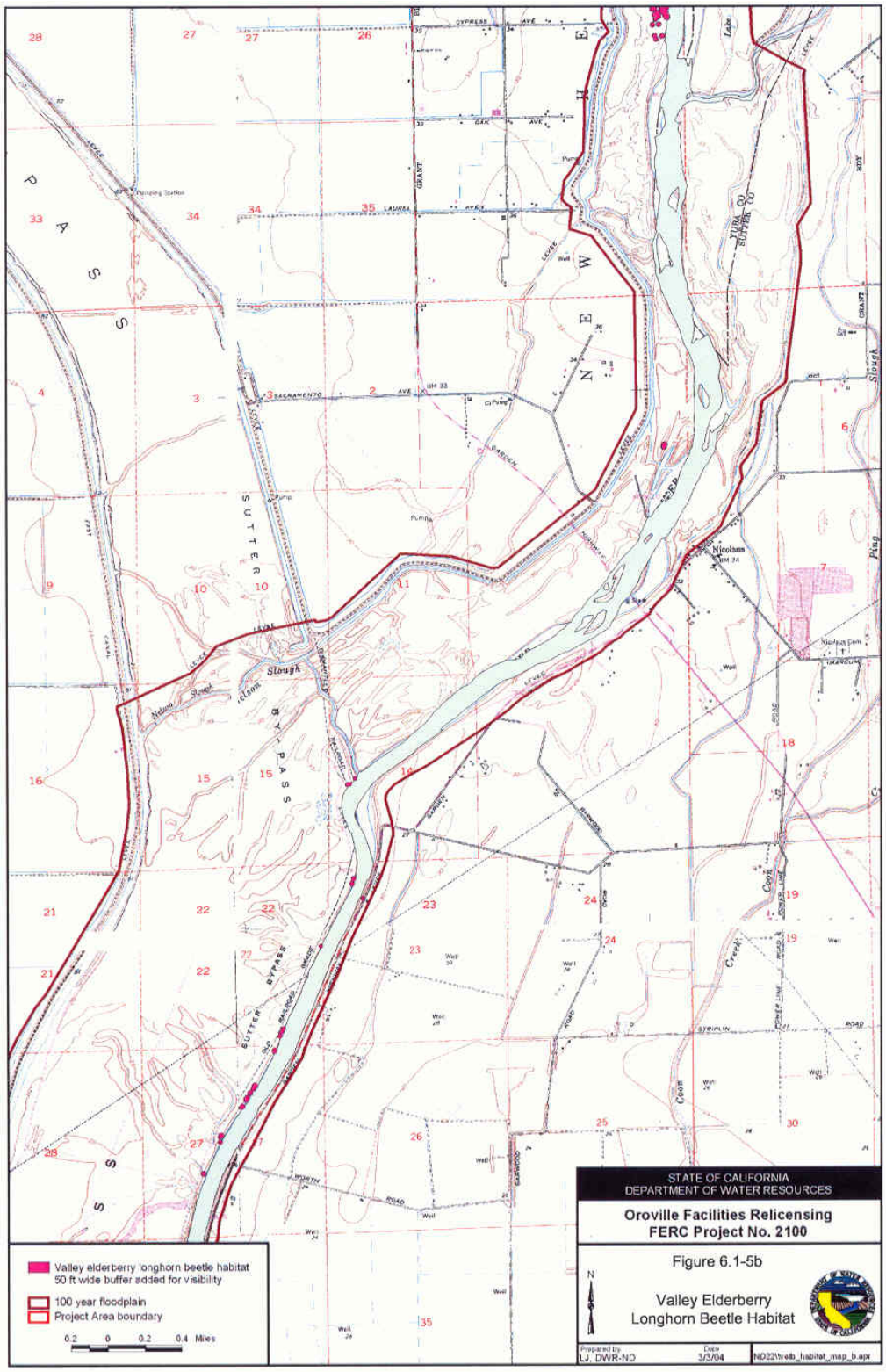

Figure 6.1-5b Valley Elderberry Longhorn Beetle Habitat.

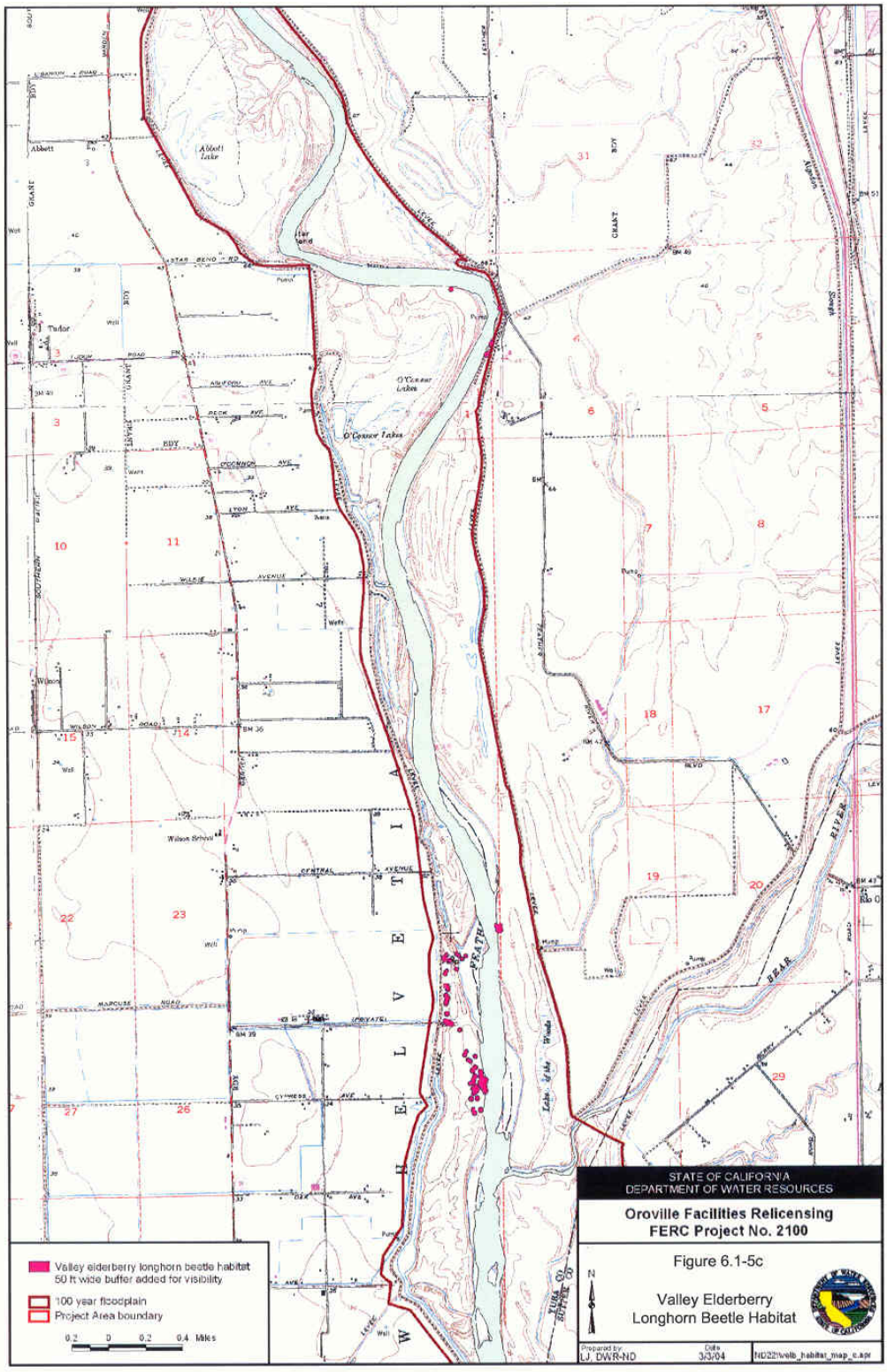

Figure 6.1-5c Valley Elderberry Longhorn Beetle Habitat.

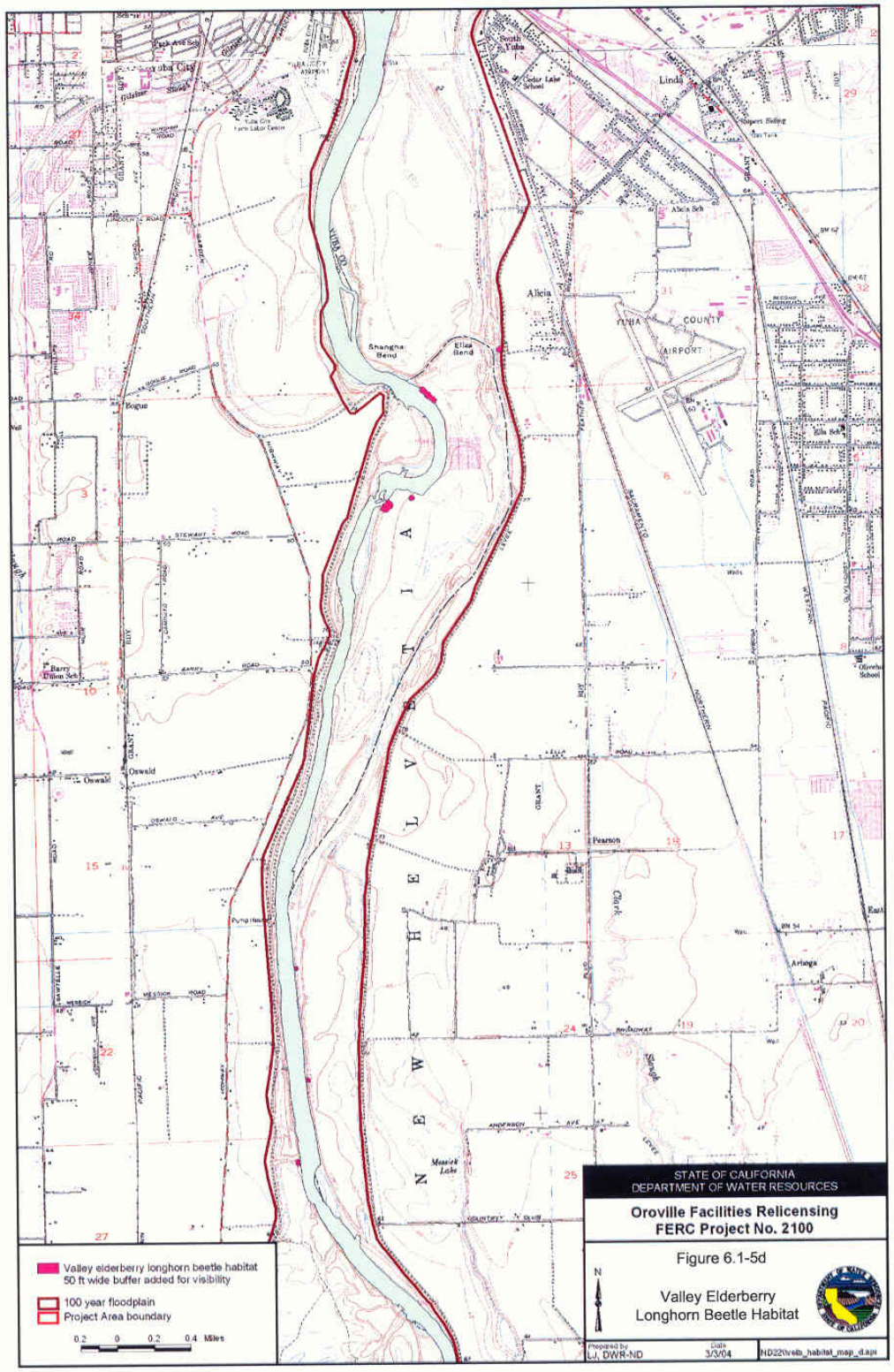

Figure 6.1-5d Valley Elderberry Longhorn Beetle Habitat.

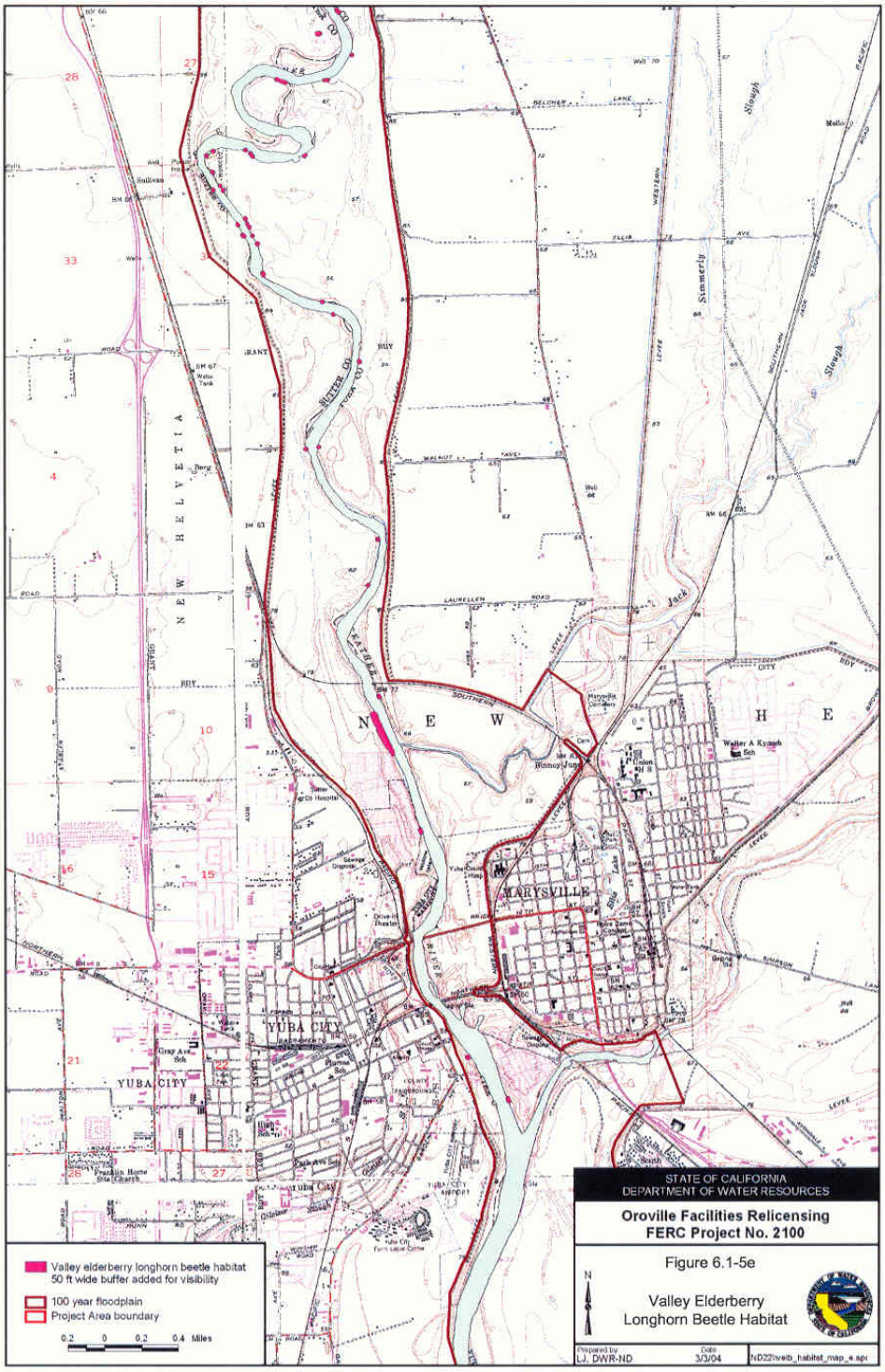

Figure 6.1-5e Valley Elderberry Longhorn Beetle Habitat.

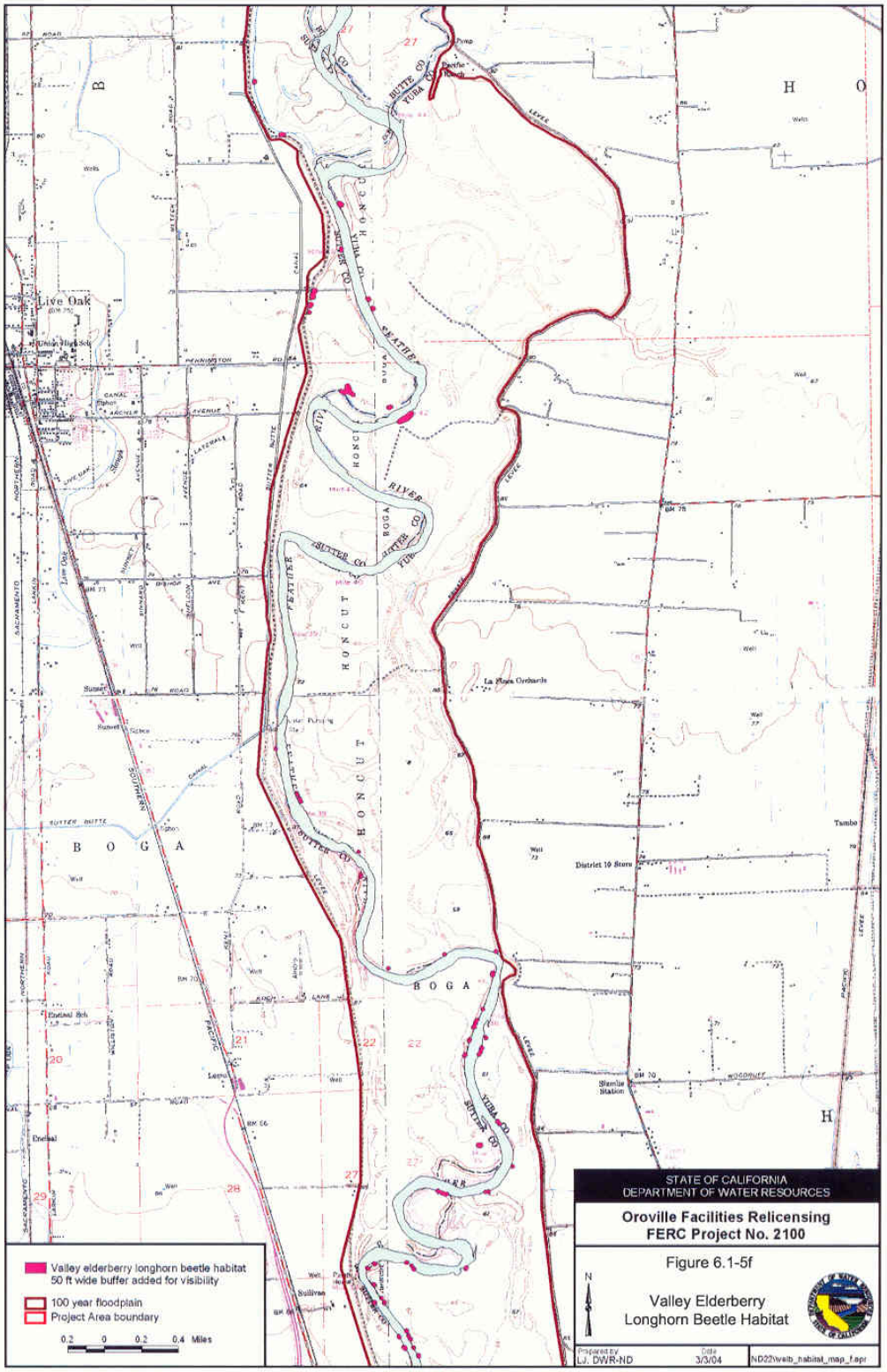

Figure 6.1-5f Valley Elderberry Longhorn Beetle Habitat.

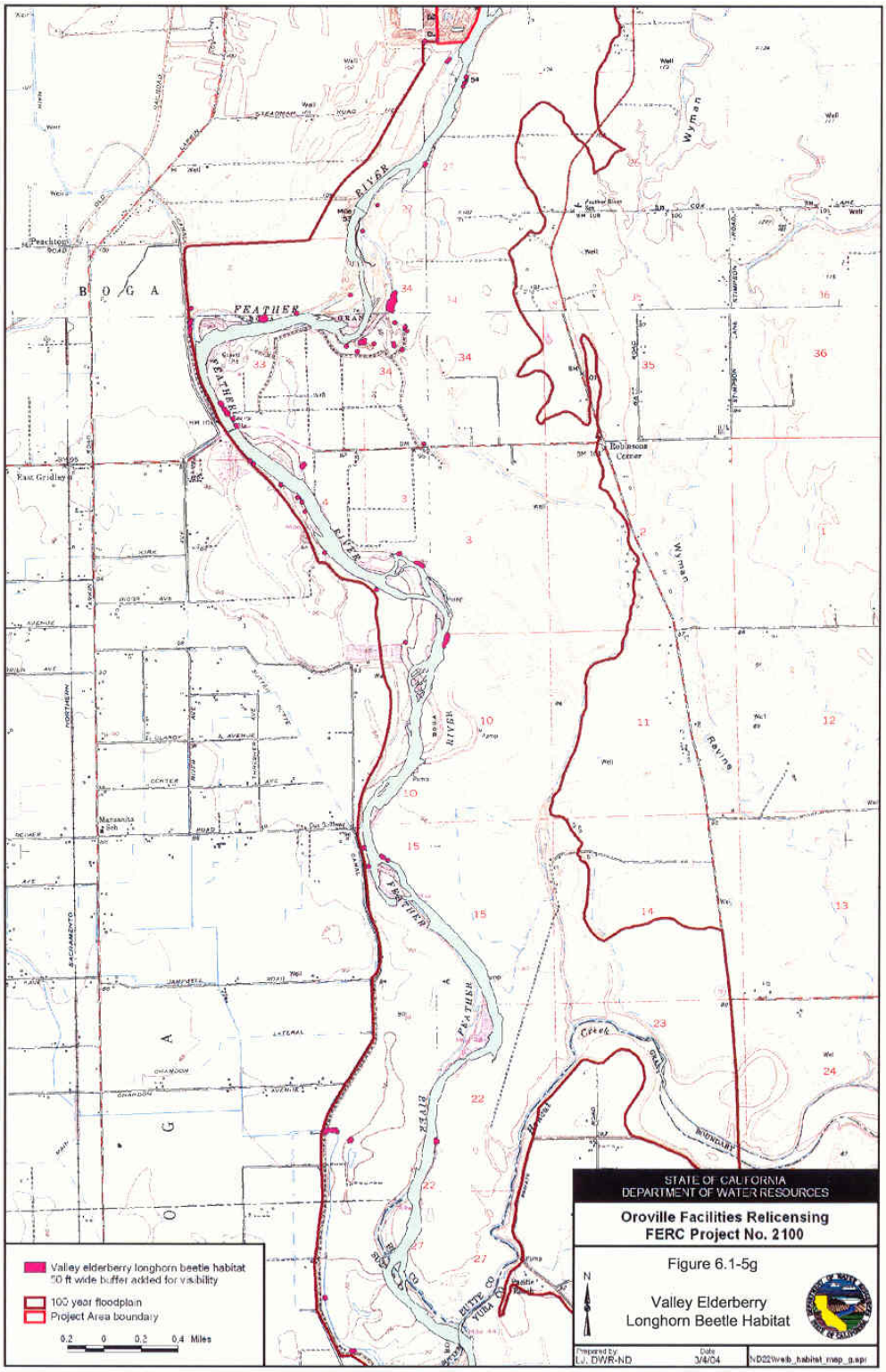

Figure 6.1-5g Valley Elderberry Longhorn Beetle Habitat.

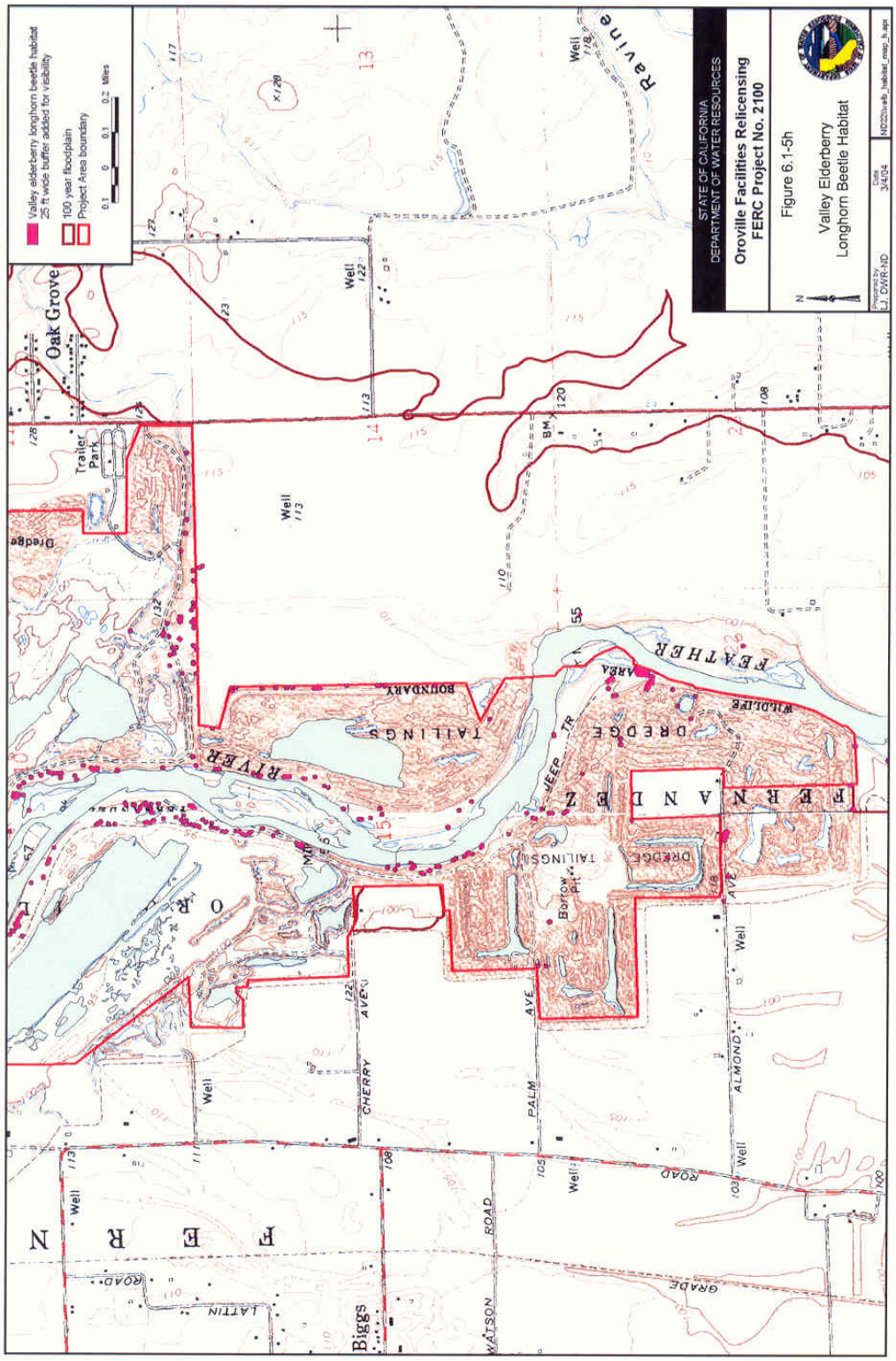

Figure 6.1-5h Valley Elderberry Longhorn Beetle Habitat.

Figure 6.1-5i Valley Elderberry Longhorn Beetle Habitat.

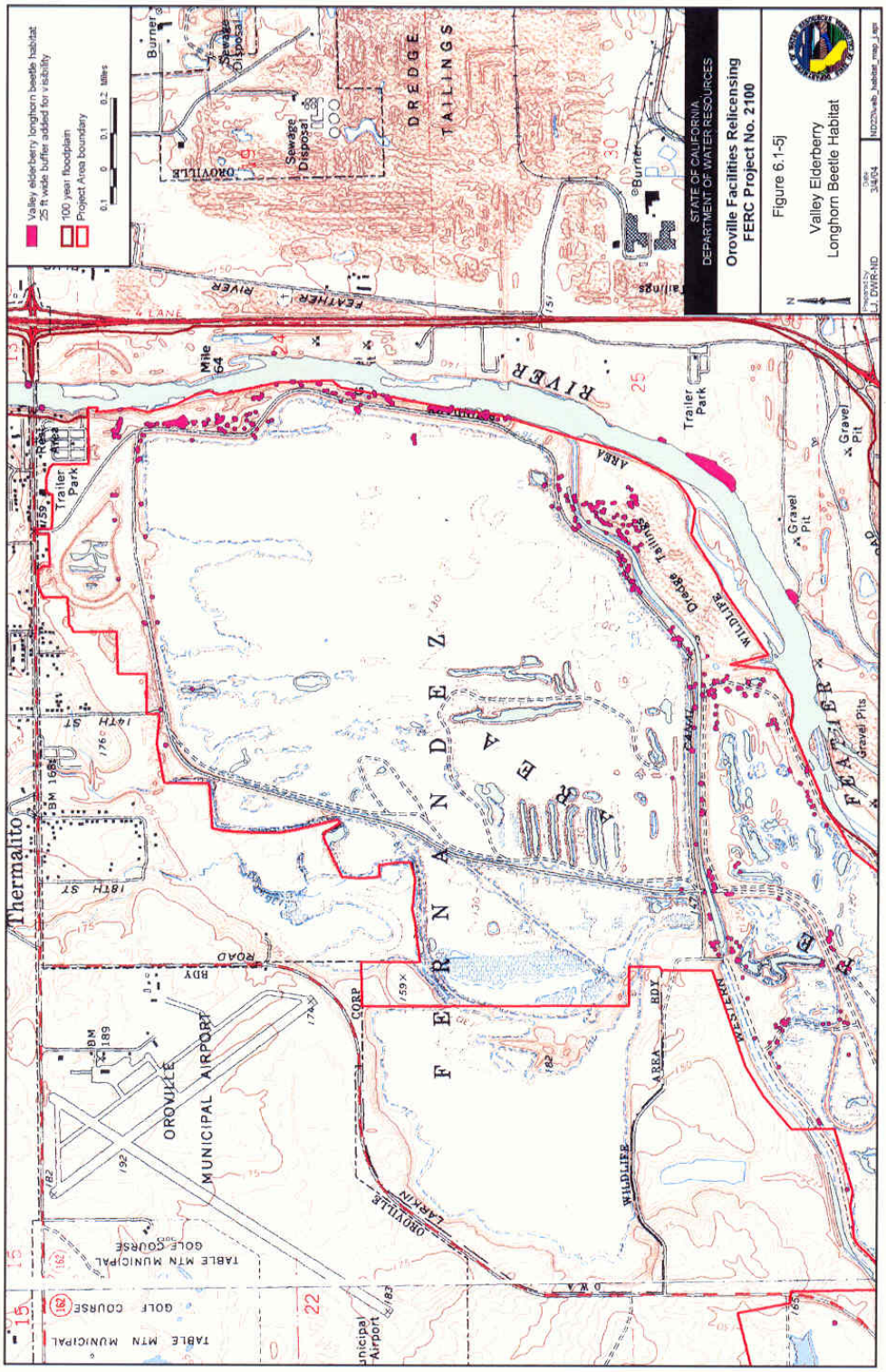

Figure 6.1-5j Valley Elderberry Longhorn Beetle Habitat.

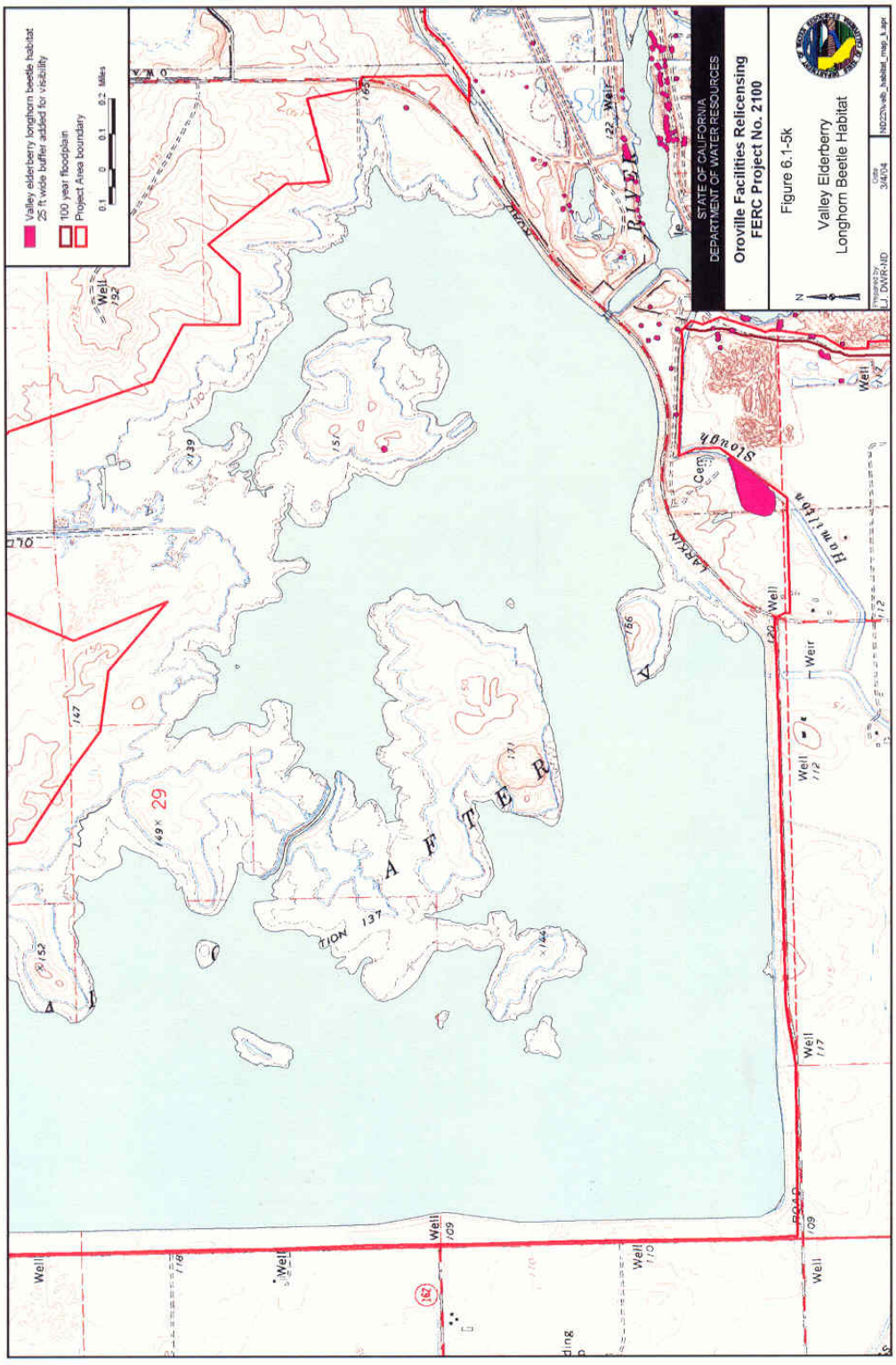

Figure 6.1-5k Valley Elderberry Longhorn Beetle Habitat.

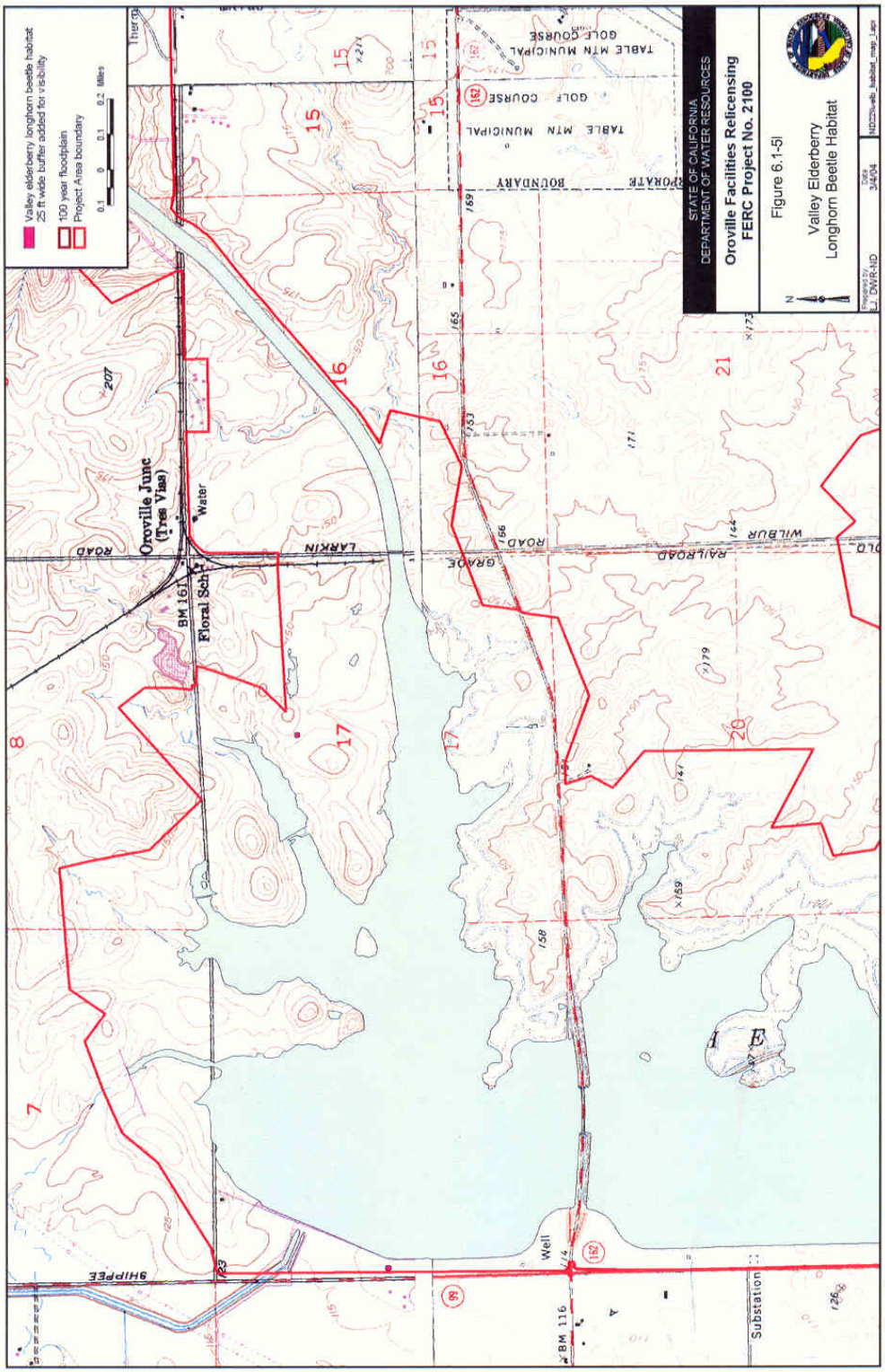

Figure 6.1-5l Valley Elderberry Longhorn Beetle Habitat.

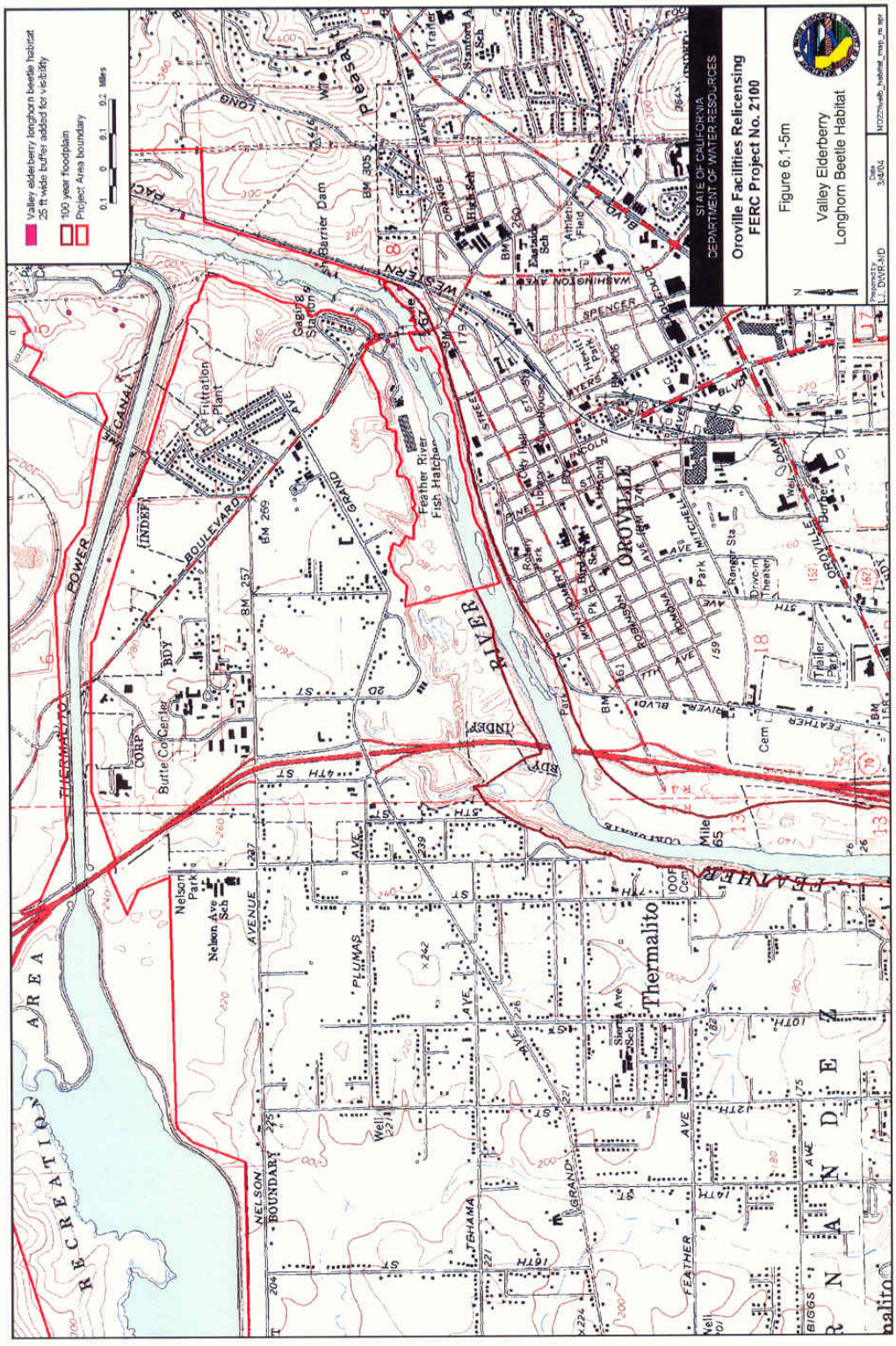

Figure 6.1-5m Valley Elderberry Longhorn Beetle Habitat.

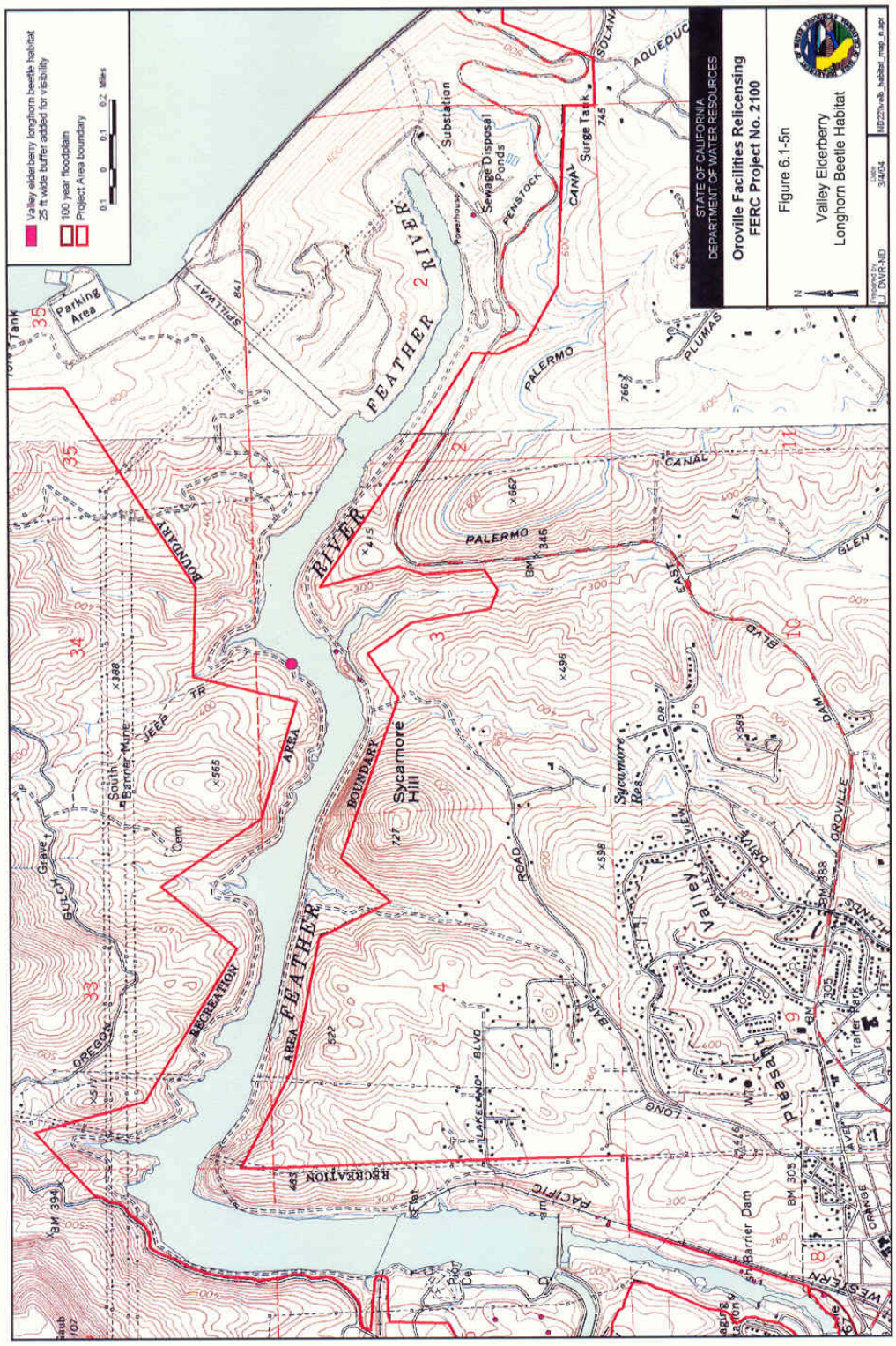

Figure 6.1-5n Valley Elderberry Longhorn Beetle Habitat.

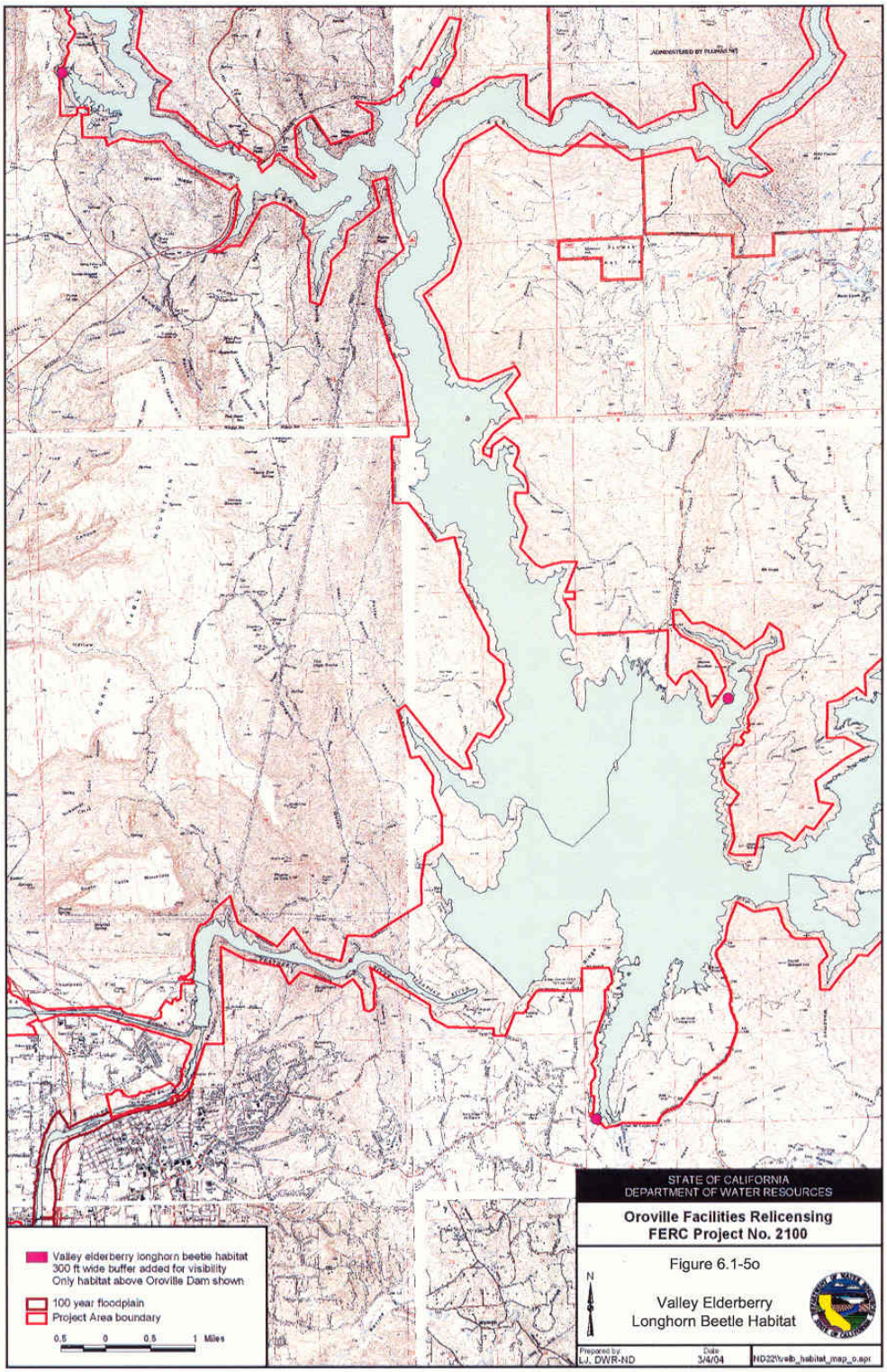

Figure 6.1-5o Valley Elderberry Longhorn Beetle Habitat.

6.1.5.4 Survey Methods and Results for the Action Area

Methods

Suitable habitat for the valley elderberry beetle includes all shrubs of the genus *Sambucus* (Barr 1991). Elderberry shrubs grow in riparian habitats that are not commonly inundated by flood waters or high water tables. However, the valley elderberry beetle inhabited elderberry plants also occur in terrestrial stands of the genus *Sambucus*, often at a considerable distance from riparian habitats. Within the FERC Project Boundary, potentially suitable habitat within 100 feet of all project features, including roads, levees, campgrounds and trails, was surveyed and mapped during the blooming period by DWR in 2002 and 2003 using USFWS protocol (USFWS Website). Potentially suitable habitat in these surveys was considered to include all elderberry shrubs regardless of stem size. The elderberry shrub habitat mapped may be periodically subject to floodwaters but is high enough above normal inundation zones that habitat is not adversely affected by the high water table (DWR 2003a).

Surveys included searching all elderberry shrubs with one or more stems measuring 1 inch or greater in diameter at ground level occurring on or adjacent to (within 100 feet). project features including roads, levees, campgrounds, and trails for beetle exit holes (DWR 2003a). In addition, all elderberry stems 1 inch or greater at ground level were tallied by diameter size class (USFWS 1999) and occurrence and number of exit holes noted. Potentially suitable habitat was surveyed along Lake Oroville, the Feather River between Oroville Dam and the Fish Diversion Pool, the Power Canal, and the Feather River below OWA to the confluence with the Sacramento River. Due to access limitations, only plants visible from boats were surveyed along Lake Oroville and along the Feather River below the OWA to the confluence with the Feather River.

Potentially suitable habitat in the OWA along the Feather River was mapped but not surveyed. Valley elderberry longhorn beetles were assumed present in suitable habitat in these areas due to the extent of elderberry shrubs occurrence and historic identification of emergence holes in 2002 and 2003 in habitat in these areas (DWR 2003a).

Results

Potentially suitable habitat was identified along the Feather River corridor between Oroville Dam and the Fish Diversion Pool and along the Power Canal. Potentially suitable habitat also occurs in the OWA and along the Feather River below the OWA to the confluence with the Sacramento River in association with levees (DWR 2003a). However, the densities of elderberry bushes were lower and disjunct along the levees of the Feather River below the OWA to the confluence with the Sacramento River and uncommon or absent from the lower portion of levees or other areas subject to a high water table. Dense stands of elderberry bushes occur on all the existing levees within the OWA bordering the Feather River. Bushes are uncommon or absent from lower elevations of the OWA off the levees where groundwater levels are high. Distribution of

the elderberry stands on the levees also provides connectivity between habitats in the OWA (DWR 2003a).

No potentially suitable habitat along Lake Oroville shoreline or the Thermalito Forebay and Thermalito Afterbay was found.

Surveys of the Lake Oroville shoreline showed that elderberry shrubs are extremely uncommon, and no shrubs were identified within 100 feet of Lake Oroville facilities including roads, campgrounds, trails, and other project facilities. Only four elderberry shrubs were identified near Lake Oroville in the Canyon Creek watershed, but these shrubs were farther than 100 feet from Lake Oroville.

Potentially suitable habitat was identified along the Feather River corridor between Oroville Dam and the Fish Diversion Pool and along the Power Canal. Within this area, 45 elderberry stems greater than 1 inch in diameter at ground level were identified. No valley elderberry longhorn beetle emergence holes were present in any of the stems; however, they are assumed present within the area.

According to DWR surveys (DWR 2003a), all of the existing levees within the portion of the OWA bordering the Feather River contain high densities of elderberry shrubs with a greater than 5-inch stem diameter, which are the preferred habitat of the valley elderberry beetle. The valley elderberry longhorn beetle prefers stems larger than 1 or 2 inches for larval development and pupation (Barr 1991). DWR surveys showed that densities of elderberry shrubs along the Feather River are lower than those within the OWA (DWR 2003a). No firm conclusions can be drawn from elderberry densities in relation to the presence of the valley elderberry longhorn beetle. As Barr stated in her studies (1991), the beetle seems to prefer situations where groups are not isolated from each other. Sites with isolated or scattered plants were encountered almost equally, while three times as many sites with scattered elderberry had valley elderberry longhorn beetle populations. At sites where elderberry was abundant, those with evidence of valley elderberry longhorn beetle exceeded the overall percentage of these categories by about a third.

6.1.6 Vernal Pool Fairy Shrimp

6.1.6.1 Biology and Ecology

The vernal pool fairy shrimp (*Branchinecta lynchi*) is endemic to the Central Valley of California and Oregon and occurs most commonly in association with vernal pool habitats. This fairy shrimp is fairly widespread in range but is not considered abundant in any locale. It is reported to occur in 26 counties in California from Riverside County in the South to Tehama County and Shasta County in the northern part of California to southern Oregon. It has been reported in the Central Coastal Mountains and South Coast Mountains, as well, but is not reported to occur above 800 feet above msl. The vernal pool fairy shrimp has been documented in Butte County and in Jackson County in Oregon as well as elsewhere in northern California (NatureServe Website).

Vernal pools are ephemeral freshwater ponds or depressions that form as a result of winter rains. They may exist in artificial depressions such as borrow pits, stock ponds, reservoirs, or any area that may collect and retain water for a few months or more. Generally, vernal pools are located in grasslands in areas of very tight or hard-pan soils. These soils are unique and are some of the oldest soils in the world—up to 600,000 years old (Barbour 1993). Some vernal pools may form on ancient basalt formations, while others may form on volcanic mudflows. With all species dependent on vernal pools, vernal pool shrimp species are contingent on seasonal fluctuations in rainfall, timing, and duration of precipitation, and water chemistry and quality. The nuances of water chemistry are still unknown for many vernal pool species (Witham, et al 1998); however, water chemistry is often cited as one of the most important factors in determining the distribution of fairy and tadpole shrimp (USFWS 1994).

The vernal pool fairy shrimp is a small aquatic crustacean belonging to the Anostraca order. It ranges in size from 0.5 to 1 inch long. Fairy shrimp have delicate elongate bodies, large stalked compound eyes, no carapace, and 11 pairs of swimming legs. They swim upside down by beating their legs in complex, wavelike movements (NatureServe Website). Fairy shrimp generally feed on algae, bacteria, protozoa, rotifers, and bits of detritus (NatureServe Website).

Vernal pool fairy shrimp have been collected from early December to early May. Female fairy shrimp carry their eggs in a ventral brood sac. The eggs are either dropped to the pool bottom or remain in the brood sac until the female dies and sinks. These resting eggs or cysts are very durable; they withstand heat, cold, and prolonged desiccation. When the pool dries out, so do the eggs. They remain on the dry pool bed until rains or some other environmental stimuli prompt them to hatch. The eggs may lay dormant for many seasons but as time passes, their viability decreases. A dry pool may contain several years breeding worth of eggs, since not all eggs hatch each season. Once the eggs hatch, the fairy shrimp swiftly progress through their stages to become adults. Average time to maturity is 41 days; however, in warmer pools it can be a little as 18 (Ericksen and Belk 1999).

Vernal pool fairy shrimp occur in a wide variety of habitat types. Specific vernal pool characteristics that determine habitat suitability are not well understood. These shrimp have been found in a variety of pool sizes, formed in various substrates. These shrimp may be found in vernal pools 79 percent of the time. Man-made or rock lined depressions make up the rest of their habitat. The occupied habitat differs greatly—alkali pools, stock ponds, seasonal drainages, and rock outcrops. Depths of the pool habitats vary as well, from frequently occupied pools that are small (<2,125 ft^2) and shallow (mean of 2 inches) to the less occupied large (480,967 ft^2) and very deep (48-inch) pools (USFWS 2003; Helm in Merced County Website).

Historical distribution of the vernal pool fairy shrimp is unknown since this species was only described in 1990. Its distribution is likely to have coincided with the historical distribution of Central Valley and Southern California vernal pools. Habitat loss in the Central Valley has been significant since the 1970s due to urban development. It has

been estimated that between 50 and 85 percent of the habitat that once supported vernal pools has been lost during this time (Witham, et al 1998). Prior to urban expansion, wide-scale habitat loss was limited due to land use patterns that preferred conversion of deeper, more friable soils for agriculture use. Grazing was commonly the only impact and, in some cases, the grazing slowed the encroachment of grasses into the pools, thus favoring shrimp (USFWS 2003; USFWS 1994).

6.1.6.2 Recovery Plan

No draft or final Recovery Plan is currently in effect for threatened and endangered brachipod species potentially occurring in vernal pool habitats in the FERC Project Boundary. As described in the final rule for designation of critical habitat for vernal pool crustaceans and plants (68 FR 46684-46781), per Section 4(b)(2) of the Endangered Species Act of 1973, as amended, lands owned by CDFG including the OWA, and lands in Butte County were excluded from the final ruling for designated Critical Habitat (68 FR 46745). The exclusion of certain areas was based on the benefits of inclusion verses the benefit of exclusion and from information received from the CDFG (68 FR 46766)**.** Butte County was excluded from the Habitat Conservation Plan for vernal pool species designated in 2003 per the final ruling (68 FR 46684). However, DWR has developed and is implementing the "Land Management Plan for the Protection of the Potential Habitat of Special Status Species of Fairy and Tadpole Shrimp" (DWR 2004a) for the protection of vernal pool invertebrate species (Appendix C)

6.1.6.3 Habitat in the Action Area

Potentially suitable habitat exists within the Action Area. DWR mapped 253 vernal pools totaling 18.3 acres with pool sizes ranging from <0.002 to 3.9 acres. The majority of vernal pools (173) are located around the Thermalito Afterbay with the remaining pools (80) located around the Thermalito Forebay (DWR 2003) (Figures 6.1-6, 6.1-6a, b, and c) (DWR 2004b).

Habitat Types and Use Patterns

Vernal pools in the Thermalito Afterbay and Thermalito Forebay are the Northern Hardpan type and occur in complexes in areas of hummocky ground on terrace-allulvial derived Redding soils (DWR 2004b).

Approximately 67 percent of the vernal pools surveyed are man-made (DWR 2004a). They are the result of impounded waters as an outcome of roads, berms, weirs, or levees. It is estimated that 56 percent of the pools occur in two clusters: (1) the south end of Wilbur Road (Figures 6.1-6a and 6.1-6b); and (2) around the South Forebay boat ramp (DWR 2004a) (Figure 6.1-6 c).

Habitat Designations

Currently the vernal pool fairy shrimp species has been mapped in only 30 vernal pools or swales as element occurrences throughout its range (NatureServe Website). Critical

habitat for the vernal pool fairy shrimp is not located within Butte County. The 2003 Critical Habitat for threatened and endangered vernal pool species did not include counties where there was no documentation of listed species or those counties where the economic assessment indicated the monetary impacts to a particular county would be too great (USFWS 2003). However, even though Butte County has only recorded populations of the vernal pool fairy shrimp at its northern boundary, it does not mean the shrimp do not occur in other portions of Butte County (CDFG 2004).

Habitat Quantity and Quality

Approximately 18.14 acres of vernal pools have been identified within the FERC Project Boundary (DWR 2003a) with approximately 67 percent of pools as a result of man-made activities. Pools in these areas range in size from very small (<3 feet in diameter) to larger pools of nearly 4 acres. Multipool complexes within the area cover between 0.5 and 5 acres. The majority of pools are fairly shallow, although large deep pools also occur. Only ten pools are equal to or larger than 0.25 acres in size. Four pools are around 0.25 acres, four pools are larger than 0.5 acres, and only two are larger than 1 acre in size. The depth of these pools was not collected during the surveys. The pools fill with water during the winter rains and as temperatures rise in February and March, water levels begin to decrease, stimulating germination and growth of early vernal pool plant species. The majority of the pools are shallow and therefore support numerous vernal pool plant species (DWR 2004a). These pools are less likely to support vernal pool invertebrates because they dry too quickly. The current conditions of the pools mapped for vernal pool invertebrates range from no impacts to sedimentation impacts from vehicles, and from disking or other mechanical impacts. Approximately 47 percent of the vernal pools have had at least one of these types of impacts (DWR 2004a).

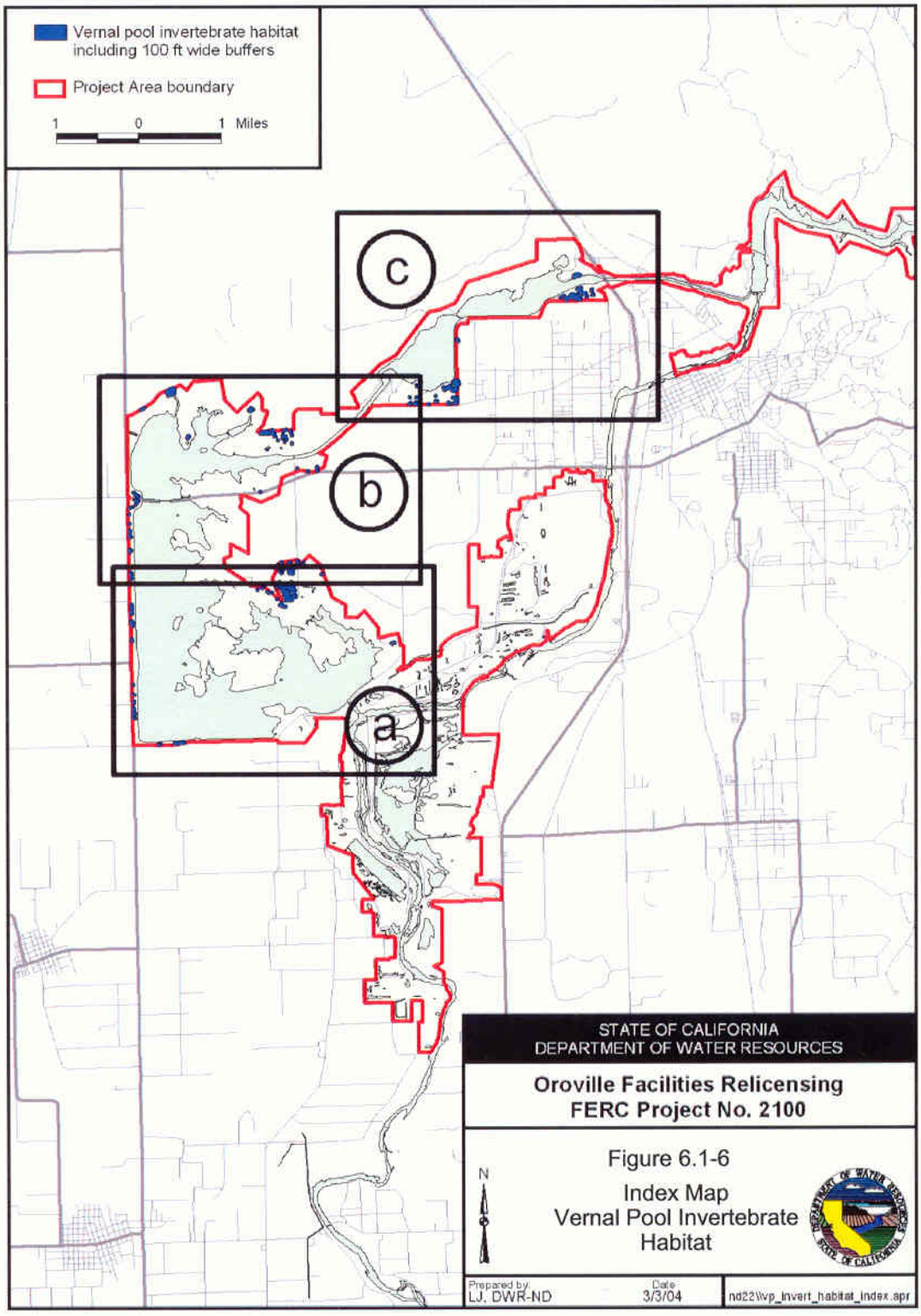

Figure 6.1-6. Index Map Vernal Pool Invertebrate Habitat.

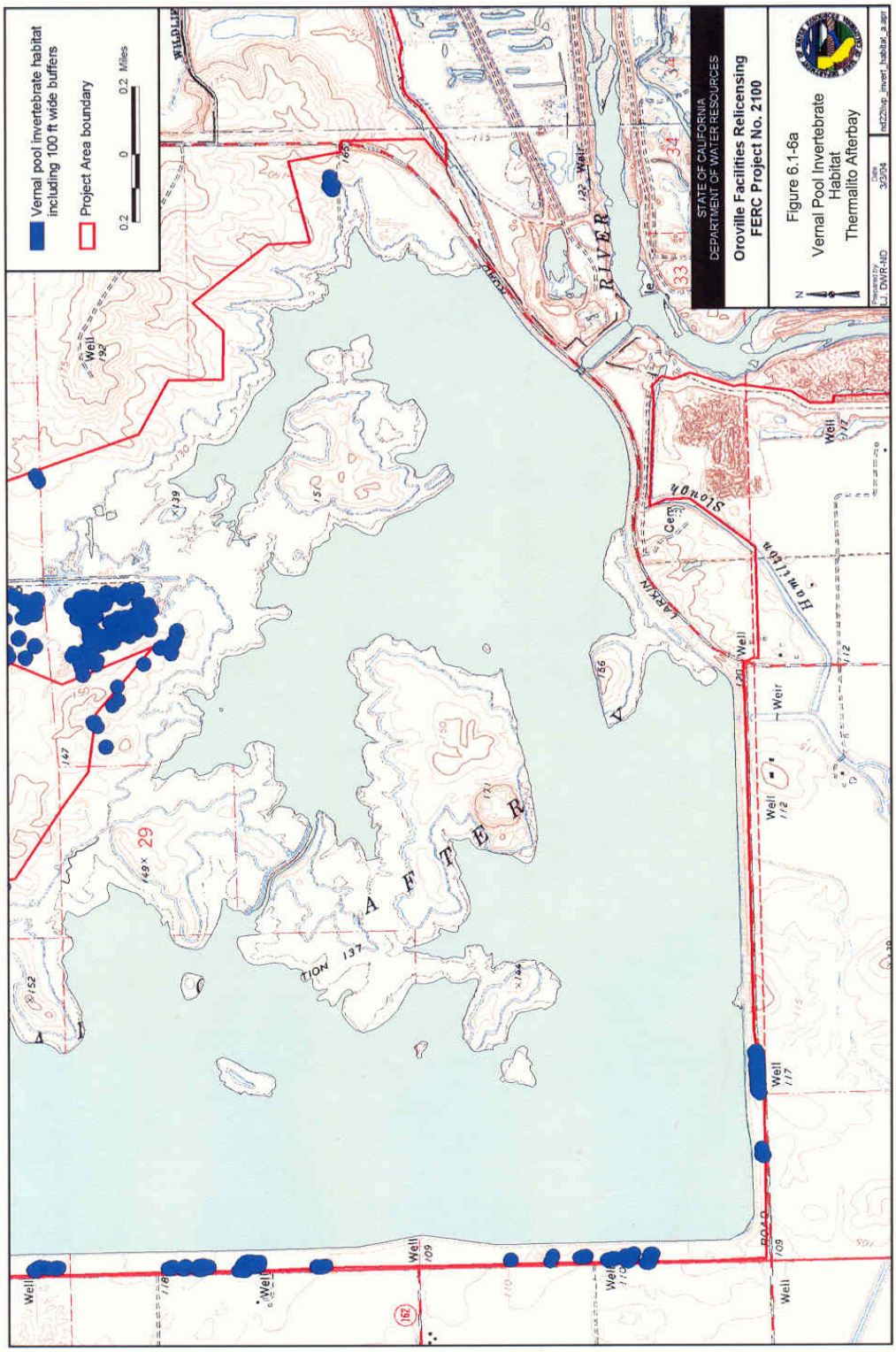

Figure 6.1-6a. Vernal Pool Invertebrate Habitat Thermalito Afterbay.

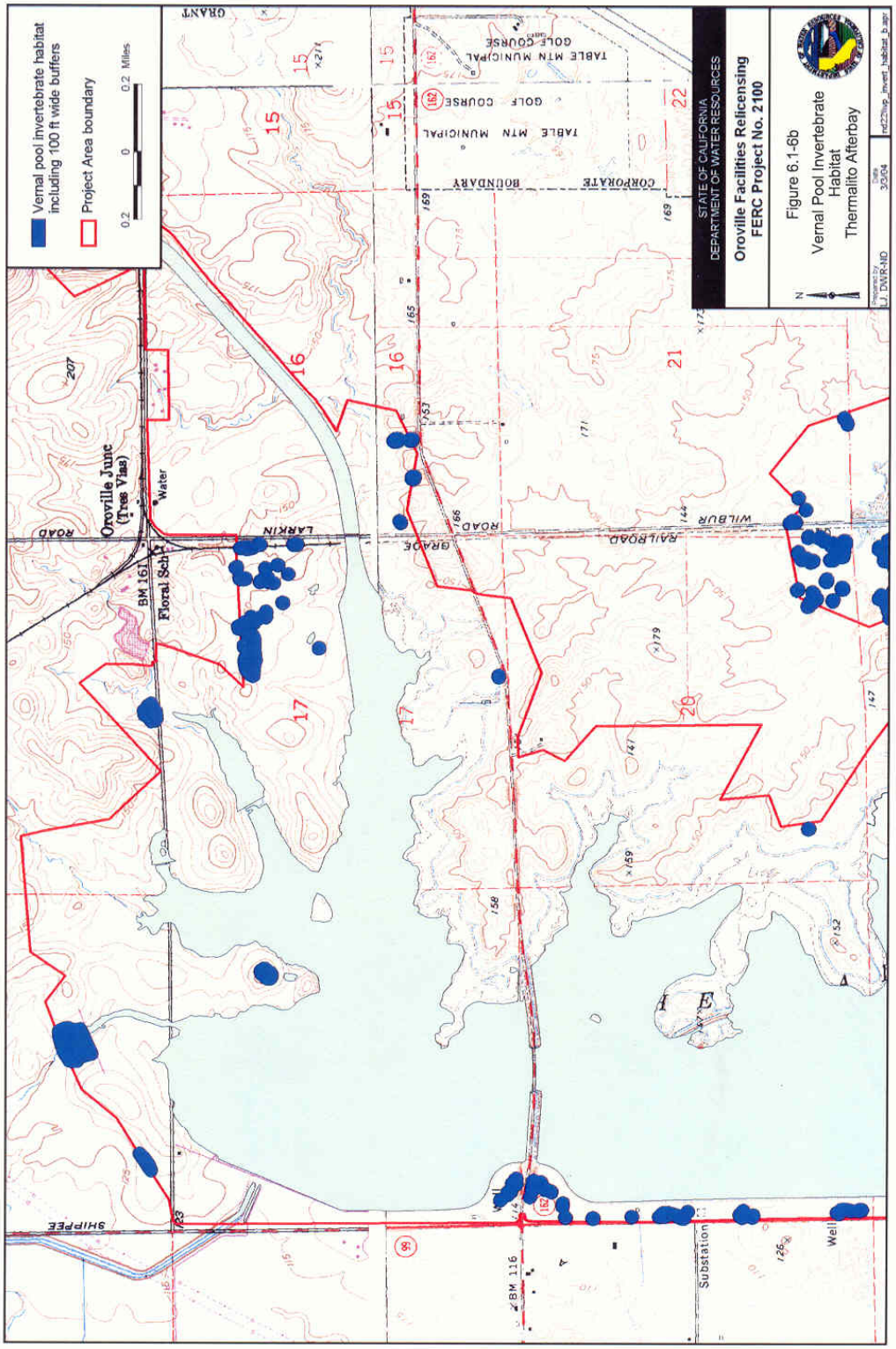

Figure 6.1-6b. Vernal Pool Invertebrate Habitat Thermalito Afterbay.

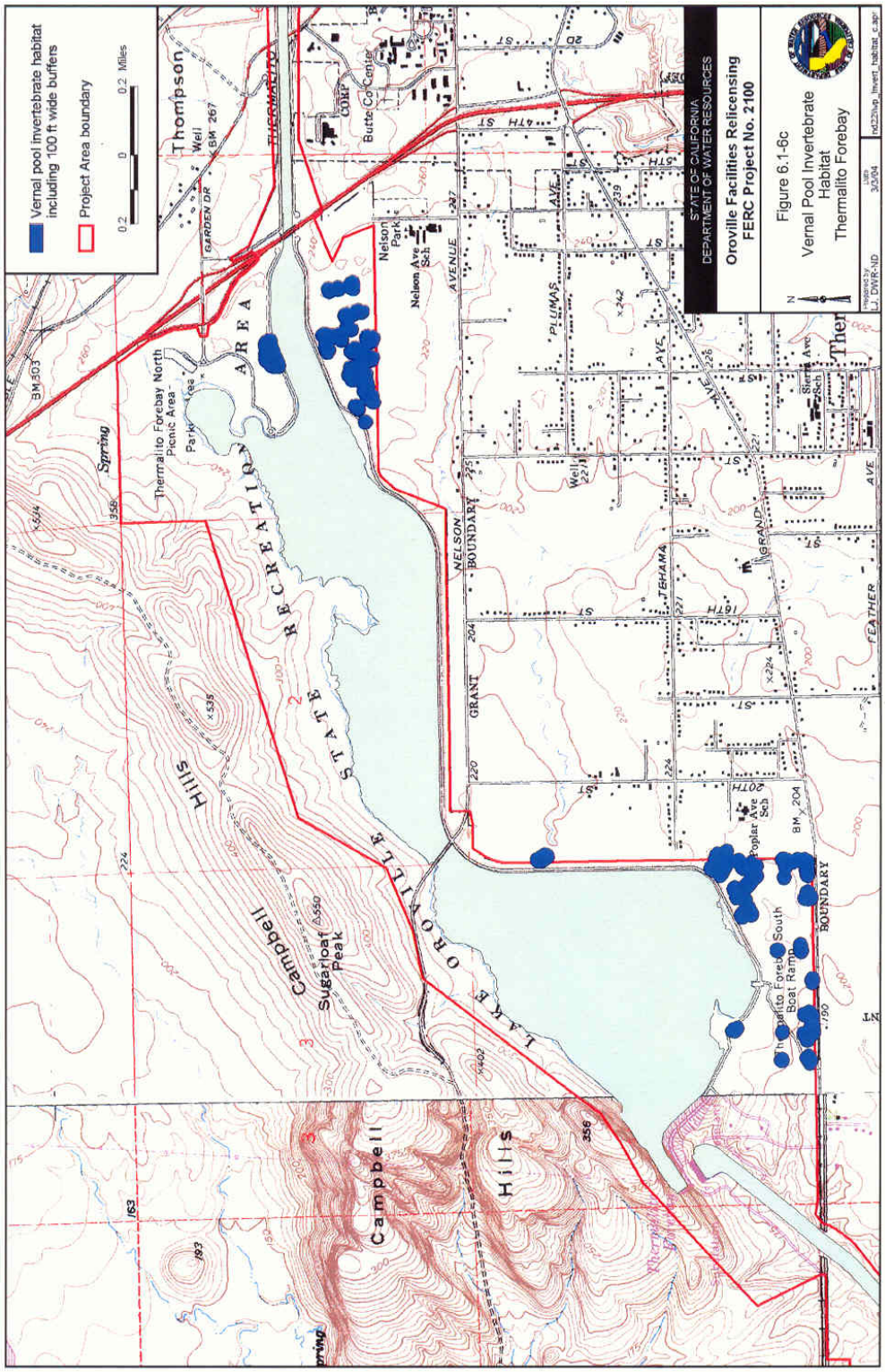

Figure 6.1-6c. Vernal Pool Invertebrate Habitat Thermalito Forebay.

6.1.6.4 Survey Methods and Results for the Action Area

Methods

Protocol level surveys for vernal pool branchiopods (Conservancy fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp) were not conducted during the relicensing studies, nor were presence or absence surveys conducted. DWR has assumed that listed species may be present (DWR 2004a) in suitable habitat. Field surveys therefore focused on identifying vernal pools and associated plant species within the FERC Project Boundary. Vernal pools were mapped during vegetation/habitat surveys. Vernal pools were initially located using National Wetland Inventory Maps; field truthing surveys were conducted in areas with high probability for vernal pools. Most of the pedestrian field surveys were conducted using a ten-meter grid (DWR 2003). The first rounds of surveys were conducted the summer and fall of 2001, where 75 percent of the pools were mapped. In the spring of 2002, previously mapped pools were verified for obligate vernal pool vegetation. Those depressions lacking appropriate vegetation or without prolonged pooling of water were dropped from consideration. The remaining 25 percent of the vernal pools were mapped during spring 2002. Locations of pools were recorded using global positioning systems (GPS) and were then mapped in an ArcView GIS format (DWR 2003).

Results

As previously indicated, potentially suitable habitat exists within the FERC Project Boundary. DWR mapped 253 vernal pools totaling 18.3 acres with pool sizes ranging from <0.002 to 3.9 acres. It is estimated that 67 percent of the vernal pools surveyed are man-made. They are the result of impounded waters as an outcome of roads, berms, weirs, or levees. It is estimated that 56 percent of the pools occur in two clusters: (1) the south end of Wilbur Road; and (2) around the South Forebay boat ramp (DWR 2004a).

There is one record of occurrence of this species adjacent to the FERC Project Boundary, just west of the Thermalito Afterbay across Highway 99 (CDFG 2004). This occurrence was recorded in a natural pool. One other record of the vernal pool fairy shrimp is located approximately 3 miles north of Thermalito Afterbay (CDFG 2004).

6.2 ENDANGERED WILDLIFE SPECIES

6.2.1 Conservancy Fairy Shrimp

6.2.1.1 Biology and Ecology

The Conservancy fairy shrimp (*Branchinecta conservatio*) is endemic to the northern Central Valley of California. The species is currently known from the following disjunct populations: (1) the Vina Plains in Tehama County; (2) south of Chico in Butte County; (3) the Jepson Prairie Preserve and surrounding area in Solano County; (4) Sacramento National Wildlife Refuge in Glenn County; (5) Mapes Ranch west of Modesto; (6) San

Luis National Wildlife Refuge and the Haystack Mountain/Yosemite Lake area in Merced County; and (7) two locations on the Los Padres National Forest in Ventura County. (USFWS 1994). According to NatureServe (NatureServe Website), the Conservancy fairy shrimp has also been recorded in Stanislaus and Yuba Counties. The CNDDB shows no records of this species within 5 miles of the Project (CDFG 2004); the closest recordation of this species is near the Vina Plains, approximately 35 miles to the northwest of the FERC Project Boundary (CDFG 2004). For a general description of vernal pool habitat, see Section 6.1.6.1.

The Conservancy fairy shrimp ranges in size from about 0.5 to 1 inch long. Fairy shrimp are aquatic species in the order Anostraca. They have delicate elongate bodies, large stalked compound eyes, no carapaces, and eleven pairs of swimming legs. They glide gracefully upside down, swimming by beating their legs in a complex, wavelike movement that passes from front to back. Fairy shrimp feed on algae, bacteria, protozoa, rotifers, and bits of detritus. (NatureServe Website).

Conservancy fairy shrimp inhabit rather large, clay bottomed, cool-water vernal pools with moderately turbid water (Eriksen and Belk 1999). According to Helm (Witham et al. 1998), Conservancy fairy shrimp occupy vernal pools, alkali vernal pools, and playa pools that have a potential ponding area of at least 15,070 ft^2 and are highly turbid. Conservancy fairy shrimp cysts lie dormant during the dry season, and hatch once the habitat is inundated and suitable environmental conditions prevail.

The Conservancy fairy shrimp is known to occur on basin rim, high terrace, and volcanic mudflow landforms (Helm and Vollmar 2001). The literature indicates that soil substrates are highly variable as are landforms. For example, some occupied pools in Glenn, Colusa and Merced counties are associated with alkaline sink areas and tend to be higher in pH and salinity than in other pools where the species is found (USFWS 2003). Shrimp occurrences have been documented on Anita, Pescadero, and Peters Clay soils in pools ranging from large (1–2 acres) to very large (88 acres). There are exceptions; pools in Montezuma Hills in Solano County and in Butte County are relatively small and have low turbidity (USFWS 2003). The pools where Conservancy shrimp occur generally last until June but the shrimp are gone long before then. They have been collected from early November to early April. The Conservancy fairy shrimp habitat suitability is not well understood, nor is their reproduction, hatching, and growth. However, the literature indicates that fairy shrimp in general are similar in their morphology and reproduction to vernal pool fairy shrimp. Studies conducted in the Vina Plains vernal pool complex have revealed that this species initiated development after cold-water flooding of pool basins and requires weeks to mature. Early April pool sampling revealed no mature individuals (Witham et al. 1998). Water in the larger pools takes longer to warm, which may explain why maturation of the fairy shrimp is delayed.

Historical distribution of the Conservancy fairy shrimp is unknown since this species was only described in 1990. Its distribution is likely to have coincided with the historical distribution of Central Valley vernal pools. Wide-scale habitat loss for this species is likely to have been early in California's history since the soils on which the preferred

vernal pools exist are fertile basin rim soils and were likely lost to agricultural conversion in the 19th century. It has been estimated that between 50 and 85 percent of the habitat that once supported vernal pools has been lost (Witham et al. 1998).

The Butte County populations are within Northern Basalt Flow vernal pools limited to ancient terraces and hilltops (USFWS 2003) just south of the Vina Plains Preserve. These occupied pools are located approximately 25 miles north of the Action Area (CDFG 2004).

6.2.1.2 Recovery Plan

No draft or final Recovery Plan is currently in effect for threatened and endangered branchiopods species potentially occurring in vernal pool habitats in the FERC Project Boundary. As described in the final rule for designation of critical habitat for vernal pool crustaceans and plants (68 FR 46684-46781), per Section 4(b)(2) of the Endangered Species Act of 1973, as amended, lands owned by California Department of Fish and Game including the Oroville Wildlife Area, and lands in Butte County were excluded from the final ruling for designated Critical Habitat (68 FR 46745). The exclusion of certain areas was based on the benefits of inclusion verses the benefit of exclusion and from information received from the CDFG (68 FR 46766). Butte County was excluded from the Habitat Conservation Plan for vernal pool species designated in 2003 per the final ruling (68 FR 46684). However, DWR has developed and is implementing the "Land Management Plan for the Protection of the Potential Habitat of Special Status Species of Fairy and Tadpole Shrimp" (DWR 2004a) for the protection of vernal pool invertebrate species (Appendix C).

6.2.1.3 Habitat in the Action Area

Potentially suitable habitat may exist within the FERC Project Boundary Action Area, although this habitat type may be limited only to the larger Northern Hardpan natural vernal pools. DWR surveys for vernal pools included areas within the FERC Project Boundary. DWR mapped 253 vernal pools totaling 18.3 acres with pool sizes ranging from <0.002 to 3.9 acres. The majority of vernal pools (173) are located around the Thermalito Afterbay with the remaining pools (80) located around the Thermalito Forebay (DWR 2003) (Figures 6.1-6, 6.1-6a, 6.1-6b and 6.1-6c) (DWR 2004).

Habitat Types and Use Patterns

Vernal pools in the Thermalito Afterbay and Thermalito Forebay are the Northern Hardpan type and occur in complexes in areas of hummocky ground on terrace-alluvial derived Redding soils (DWR 2004b).

It is estimated by DWR that 67 percent of the vernal pools surveyed are man-made. They are the result of water impounded as an outcome of roads, berms, weirs, or levees. It is estimated that 56 percent of the pools occur in two clusters: (1) the south end of Wilbur Road (Figures 6.1-6a and 6.1-4b) and (2) around the South Forebay boat ramp (Figure 6.1-6c)(DWR 2003).

Habitat Designations

Only a handful of disjunct localities are mapped for the Conservancy fairy shrimp. Some are managed as preserves, such as the Vina Plains Preserve in Tehama County, under the stewardship of the Nature Conservancy (NatureServe Website). The largest threat to these vernal pool species is urban expansion and agricultural conversion. Other threats exist as well, such off-highway vehicle activity. Critical habitat for the Conservancy fairy shrimp is not located within Butte County. The 2003 Critical Habitat for Threatened and Endangered Vernal Pool Species (USFWS 2003) did not include counties that did not have documentation of listed species within their boundaries or those counties where the economic assessment indicated the monetary impacts to a particular county would be too great (USFWS 2003).

While the occurrence of vernal pool fairy shrimp is documented near the FERC Project Boundary west of the Thermalito Afterbay and in a vernal pool complex located approximately 3 miles north of the FERC Project Boundary above the Thermalito Afterbay (CDFG 2004), occurrences of the Conservancy fairy shrimp are not currently known from on the Action Area (CDFG 2004). The latter vernal pool is listed as a Northern Volcanic Mudflow vernal pool. The former occurrence has no habitat attributes.

Habitat Quantity and Quality

The approximately 18.3 acres of vernal pools range in size from very small (< 3 feet in diameter) to larger pools of nearly 4 acres. Multipool complexes within the area cover between 0.5 and 5.0 acres. The majority of pools are fairly shallow, although large deep pools also occur. These larger pools may be suitable for the Conservancy fairy shrimp. The pools fill with water during the winter rains. As temperatures rise in February and March, water levels begin to decrease, stimulating germination and growth of early vernal pool plant species. These vernal pools support numerous vernal pool plant species (DWR 2004b).

6.2.1.4 Survey Methods and Results for the Action Area

Methods

DWR has assumed that listed branchiopod species may be present (DWR 2004a) in suitable habitat within the FERC Project Boundary. Therefore, protocol level surveys or presence or absence surveys for vernal pool branchiopods (Conservancy fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp) were not conducted during the relicensing studies. Field surveys focused on identifying vernal pool habitat and associated plant species within the FERC Project Boundary.

Vernal pools were mapped during vegetation/habitat surveys. Vernal pools were initially located using National Wetland Inventory Maps, and then field truthing surveys were conducted in areas with high probability for vernal pools. Most of the pedestrian field surveys were conducted using a 10-meter grid (DWR 2003). The first rounds of surveys

were conducted during the summer and fall of 2001, where 75 percent of the pools were mapped. In the spring of 2002, previously mapped pools were verified for obligate vernal pool vegetation. Those depressions lacking appropriate vegetation or without prolonged pooling of water were dropped from consideration. The remaining 25 percent of the vernal pools were mapped in the spring of 2002. Locations of pools were recorded using GPS and were then mapped in an ArcView GIS format (DWR 2003).

6.2.2 Vernal Pool Tadpole Shrimp

6.2.2.1 Biology and Ecology

Vernal pool tadpole shrimp (Lepidurus packardi) is endemic to the Central Valley of California. It is reported to occur in 16 counties ranging from Shasta County in the north to Tulare in the south (NatureServe Website). It has occupied habitats from the foothills of the Sierra Nevada to the Cascade Range below 800 feet msl. It is found as far west as Alameda and Solano Counties (CDFG 2004).

Vernal pool tadpole shrimp is a small freshwater aquatic crustacean belonging to the order Notostraca. Tadpole shrimp have dorsal compound eyes, a large shield-like carapace that covers a large part of the body and a pair of long cercopods (appendages) at the end of the last abdominal segment. Vernal pool tadpole shrimp adults can reach 2 inches in length. They have about 35 pairs of legs and swim primarily with their legs down. This species superficially resembles the rice field tadpole shrimp (Triops longicaudatus) but is apparently disjunct in its distribution (USFWS 1994).

Tadpole shrimp climb or scramble over objects, as well as plow along or within bottom sediments. Their diet consists of organic detritus and living organisms, such as fairy shrimp and other invertebrates (NatureServe Website). These shrimp are found in vernal pools containing clear to highly turbid water, with pools ranging in size from 54 square feet in the former Mather Air Force Base area of Sacramento County, to the 89-acre Olcott Lake at Jepson Prairie.

The life history of the vernal pool tadpole shrimp is linked to the seasonal cycle of its vernal pool habitat. After winter rainwater fills the pool, the population is reestablished from cysts that lie dormant in the dry pool sediments. Sexually mature adults have been observed in vernal pools three to four weeks after the pools had been filled (USFWS 1994). Other literature indicates that sexual maturity is reached between six and seven weeks (Ahl 1991). The variables may be water temperature and food supply. Vernal pool tadpole shrimp are described as bisexual (hermaphroditic) and are capable of self-fertilization. Once fertilization has taken place, the shrimp deposit their eggs on vegetation and other objects on the bottom. Some eggs hatch immediately, while others remain dormant cysts in the soil and hatch during later rainy seasons. Hatching of dormant cysts has been documented as early as four days after inundation when incubated at 10 degrees Celsius.

The vernal pool tadpole shrimp have been documented in the Vina Plains as having more than one generation of shrimp in nearly all pools, regardless of pool size (Witham et al. 1998). These observations were based on individuals' carapace sizes at the time of sampling. The larger the pool, the longer the first generation lived and the longer this generation contributed to the cyst bank. In the larger pools, the second generation matured more slowly or was delayed in maturation. These pools usually become dry in June, with total mortality. The smaller the pools, the lower number of cysts were produced by the adults (Witham, et al 1998). In these pools, density indices were high (20 to 80 per mi^2) when pre-reproductive individuals were present and low (10 per mi^2) in late season samples (Witham, et al 1998).

Vernal pool types and soil associated with areas of concentration of vernal pool tadpole shrimp differ greatly across the geographic range of the species. These differences lead to different species compositions and environmental conditions between vernal pool tadpole shrimp occurrences. Pool depth and size are also highly variable. The literature gives various preferred pool temperatures, and it assumed this is because of pool types. The northern range of this tadpole shrimp consists of Northern Basalt Mud Flow vernal pools, which are limited to ancient terraces and hilltops that compose some of the oldest geologic formations in California. The Vina Plains Preserve located in Tehama County is a good example of these types of pools. These formations are also found in Butte County. Northern Volcanic Mudflow vernal pools are delineated in Butte, Tehama, Shasta, and Yuba Counties. These pools are generally small and tend to be inundated for a short period of time. Other occurrences are within claypan and hardpan. Grassland pools in Yuba County have been described as developed on four types of geologic formations (Modesto, Riverbank, Laguna, and Mehrten Formations). It appears that since the tadpole shrimp occupy extremely different pool types with various substrates, that many of these populations are described as genetically different from one another (USFWS 2003). The variation in habitat is best described as disparate since they have been documented as occurring in a variety of artificially created pools, including stock ponds, reservoirs, ditched, backhoe pits, and vehicular ruts. This may indicate that disturbed habitats favor this shrimp species (NatureServe Website).

6.2.2.2 Recovery Plan

No draft or final recovery plan is currently in effect for threatened and endangered branchiopods species potentially occurring in vernal pool habitats in the FERC Project Boundary. As described in the final rule for designation of critical habitat for vernal pool crustaceans and plants (68 FR 46684-46781), per Section 4(b)(2) of the Endangered Species Act of 1973, as amended, lands owned by CDFG including the OWA, and lands in Butte County were excluded from the final ruling for designated Critical Habitat (68 FR 46745)**.** The exclusion of certain areas was based on the benefits of inclusion verses the benefit of exclusion and from information received from the CDFG (68 FR 46766)**.** Butte County was excluded from the Habitat Conservation Plan for vernal pool species designated in 2003 per the final ruling (68 FR 46684. However, DWR has developed and is implementing the "Land Management Plan for the Protection of the

Potential Habitat of Special Status Species of Fairy and Tadpole Shrimp" (DWR 2004a) (Appendix C) for the protection of vernal pool invertebrate species.

6.2.2.3 Habitat in the Action Area

Potentially suitable habitat may exist within the FERC Project Boundary Action Area, including 253 vernal pools totaling 18.3 acres with pool sizes ranging from <0.002 to 3.9 acres (DWR 2004b). The majority of vernal pools (173) are located around the Thermalito Afterbay with the remaining pools (80) located around the Thermalito Forebay (DWR 2003) (Figures 6.1-6, 6.1-6a, b, and c).

Habitat Types and Use Patterns

Vernal pools in the Thermalito Afterbay and Thermalito Forebay are classified as the Northern Hardpan type (Sawyer-Keeler Wolf 1995) and occur in complexes in areas of hummocky ground on terrace-alluvial derived Redding soils (DWR 2004b).

Approximately 67 percent of the vernal pools surveyed are man-made (DWR 2004a). They are the result of water impounded as an outcome of roads, berms, weirs, or levees. It is estimated that 56 percent of the pools occur in two clusters: (1) the south end of Wilbur Road (Figure 6.1-6a and 6.1-6b); and (2) around the South Forebay boat ramp (DWR 2004a) (Figure 6.1-6c).

Habitat Designations

The vernal pool tadpole shrimp is reported to occur in 33 percent of all seasonal wetlands in the Central Valley of California (NatureServe Website). Although occurrences of the vernal pool tadpole shrimp are recorded in Butte County, the USFWS has not designated Critical Habitat within the county. According to the CNDDB records, there are three locations with vernal pool tadpole shrimp within 5 miles of the FERC Project Boundary (CDFG 2004). One record is from a vernal pool complex located approximately 2.3 miles north of the Thermalito Forebay. The other occurrences are located just outside the northwestern FERC Project Boundary at the Thermalito Afterbay (CDFG 2004). The vernal pool tadpole shrimp occur within the same vernal pools as the vernal pool fairy shrimp (CDFG 2004). It is likely that vernal pool tadpole shrimp occupy vernal pool habitat within the FERC Project Boundary.

Habitat Quantity and Quality

DWR mapped 18.3 acres of vernal pools with approximately 67 percent of pools as a result of man-made activities. Pools range in size from very small (< 3 feet in diameter) to larger pools of nearly 4 acres. Multipool complexes within the area cover between 0.5 and 5.0 acres. The majority of pools are fairly shallow, although large deep pools also occur. The pools fill with water during the winter rains and as temperatures rise in February and March, water levels begin to decrease, stimulating germination and growth of early vernal pool plant species. These vernal pools support numerous vernal pool plant species (DWR 2004b).

6.2.2.4 Survey Methods and Results for the Action Area

Methods

Vernal pools were mapped during vegetation/habitat surveys. Vernal pools were initially located using National Wetland Inventory Maps, and then field truthing surveys were conducted in areas with high probability for vernal pools. Most of the pedestrian field surveys were conducted using a 10-meter grid (DWR 2003). The first rounds of surveys were conducted the summer and fall of 2001, where 75 percent of the pools were mapped. In the spring of 2002, previously mapped pools were verified for obligate vernal pool vegetation. Those depressions lacking appropriate vegetation or without prolonged pooling of water were dropped from consideration. The remaining 25 percent of the vernal pools were mapped the spring of 2002. Additional plant surveys are to be conducted in 2004 per request of USFWS (pers. comm., Bogener 2004). Locations of pools were recorded using GPS and then mapped in an ArcView GIS format (DWR 2003).

Results

DWR has assumed that listed species may be present (DWR 2004a) in suitable habitat within the FERC Project Boundary Action Area. Therefore, protocol level surveys or presence and absence surveys for vernal pool branchiopods (Conservancy fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp) were not conducted during the relicensing studies. Field surveys focused on identifying vernal pool habitat within the Project Area and associated plant species.

6.3 CANDIDATE WILDLIFE SPECIES

6.3.1 Western Yellow-Billed Cuckoo

6.3.1.1 Biology and Ecology

The western yellow-billed cuckoo (*Coccycus americanus ssp. occidentails)* is a member of the avian order Cuculiformes and Cuculidae family, which are distinguished by feet with two toes facing forward and two pointing backward (zygodactyl). There are only three genera totaling six species found in North America. The western yellow-billed cuckoo is currently not recognized by the American Ornithologists' Union (AOU) as a subspecies. The AOU only recognizes the yellow-billed cuckoo (*Coccycus americanus)* with its range from the riparian west to the deciduous forests of the east where it is a common bird (AOU Website). The status of the subspecies designation had been questioned by some but now is currently becoming accepted by most ornithologists. This is based on using applicable statistical analysis (multivariate) to demonstrate the difference between the eastern and western yellow-billed cuckoos. After the reevaluation of this data the species was listed as a candidate species (USFWS 2001).

The yellow-billed cuckoo is a medium-sized bird, about 12 inches in length and weighing about 2 ounces, occurring within suitable riparian forest habitat along rivers

primarily in the Central Valley. Yellow-billed cuckoos are primarily foliage gleaners, although they may catch flying prey, or drop to the ground to catch grasshoppers or tree frogs. They appear to specialize in large-sized prey. Food types in order of dominance are caterpillars (primarily sphinx moth larvae), katydids, tree frogs, and grasshoppers. Some observations of reproductive success relative to food sources has been noted on the Kern River (Laymon et al. 1997). There, the number of eggs laid was positively correlated to the percent of katydids fed to the young and negatively correlated to the percent of green caterpillars fed to the young. The total number of young fledged per pair was correlated to the capture time of all food types, with the shorter capture time associated with more young fledged (Laymon et al. 1997).

Western yellow-billed cuckoos require large blocks of riparian habitat for nesting (particularly woodlands with cottonwoods [*Poplus* spp.] and willows [*Salix* spp.]) while eastern yellow-billed cuckoos breed in a wider range of habitats, including deciduous woodlands and parks (Ehrlich et al. 1988). A diverse riparian site that is close to water or is sufficiently humid is generally associated with western cuckoo habitat. An understory of dense foliage (usually willow species) is preferred for nest cover while cottonwood or other riparian tree species along with orchards may provide foraging habitat (Laymon et al. 1997). Nesting peaks later (mid-June through August) than in most co-occurring bird species because yellow-billed cuckoos can delay egg laying up to a month to coincide with greater food availability. Clutch size is usually two or three eggs, but may be up to five. Development of the young is rapid, with incubation to fledging at less than 17 days (Hughes 1999). The young are able to fly at 21 days. Little is known of juvenile dispersion other than the juveniles begin migration within a few weeks. Generally, only one brood is produced per season but that is entirely dependent on available food. On the South Fork Kern River, in years of abundant food resources, up to three broods have been documented (Laymon et al. 1997).

Along the Sacramento River, nesting yellow-billed cuckoos occupied home ranges, which included 25 acres or more of riparian habitat (Laymon et al. 1997). Another study on the same river found riparian patches with yellow-billed cuckoo pairs to average 99 acres (Halterman 1991). Home ranges in the South Fork of the Kern River in California averaged about 42 acres (Laymon et al. 1997). However, the Riparian Bird Conservation Plan outlines that optimal habitat patches should be of 50 to 60 acres with a minimum of 25 acres and the optimal habitat patch size for a pair would be at least 180 acres or more in area, with a width of more than 600 meters (as the habitat block is parallel to a river) (RHJV 2000).

Yellow-billed cuckoos are loosely territorial. They do not defend a territory but, given uniform habitat, they are regularly spaced within it. Nesting densities ranging from one to 15 pairs per 99 acres were estimated in a New Mexico study and three plots in Arizona had densities ranging of 8.2, 19.8, and 26.5 pairs per 99 acres (USFWS 2001). However, it appears that densities are based on available food sources and are variable.

The western yellow-billed cuckoo breeds in scattered locations where suitable habitat is available throughout California, Idaho, Utah, Arizona, New Mexico, extreme western Texas, and possibly Nevada and western Colorado. Its historical breeding range was significantly larger. In California, historical accounts of the bird indicated that it was a common breeding species in riparian habitat throughout much of lowland California along river corridors and on the east side of the Sierra up to Surprise Valley at the base of the Warner Range. The current breeding distribution in California of greater than five pairs is limited to the Sacramento River from Red Bluff to Colusa and the South Fork Kern River from Isabella Reservoir to Cranebrake Ecological Reserve (Laymon in CPIF Website). Other small populations with breeding pairs of less than five are located at the Feather River from Oroville to Verona (Butte, Yuba and Sutter Counties); the Prado Flood Control Basin (San Bernardino and Riverside counties); the Amargosa River near Tecopa, (Inyo County); the Owens Valley near Lone Pine and Big Pine (Inyo County); the Santa Clara River near Santa Clara (Los Angeles County); the Mojave River near Victorville (San Bernardino County); and the Colorado River from Needles (San Bernardino County) to Yuma Arizona (Imperial County) (Laymon in CPIF Website).

The species overwinters from Columbia and Venezuela, south to northern Argentina (Ehrlich et al. 1988). Migration patterns, corridors and critical stopovers are largely unknown. Like most songbirds, the yellow-billed cuckoo migrates at night. The extent to which yellow-billed cuckoos nesting in different regions of North America commingle during migration or while overwintering is unknown (Laymon in CPIF Website).

A statewide survey of the western yellow-billed cuckoo was conducted in 1986 and 1987; a total of 30 to 33 pairs and 31 unmated males were found at nine localities (Laymon and Halterman 1989). The majority were along the upper Sacramento River from Red Bluff to Colusa (18 pairs and 19 unmated males) and at the South Fork Kern River (7 pairs and 3 unmated males). The remaining cuckoos were found at scattered locations including one pair and five unmated males along the Feather River; one to four pairs in the Prado Flood Control Basin; one unmated male at the Mojave River near Hodge; one unmated male in the Owens Valley; one pair along the Amargosa River near Tecopa; one pair and one unmated male along the Colorado River north of Blythe; one unmated male along the Colorado River in the Picacho Region; and one pair along the Colorado River in the Laguna Dam Region (CALPIF Website).

More recent surveys on the Sacramento River from 1987 to 1990 have shown a fluctuating population of 23 to 35 pairs (Halterman 1991). Continuous surveys on the South Fork Kern River from 1985 to 1996 have shown a population that varied from a low of 2 pairs in 1990 to a high of 24 pairs in 1992 (Laymon et al. 1997). These two sites are the only localities in California that sustain breeding populations of yellow-billed cuckoos.

Habitat loss is directly correlated with the manipulation of perennial rivers and streams. Diversions for irrigation, historic mining practices, logging, livestock grazing, and agricultural conversion have also resulted in the degradation of habitat. Construction of dams created impoundments that flooded native riparian communities, as well as

altering hydrologic flood regimes, which are essential in maintaining native riparian ecosystems (Halterman 1991). Eliminating flood events removed that catalyst for riparian species recruitment. Diversion of water caused the lowering of near-surface groundwater making it more difficult for young riparian plants to become established within a wider band along a watercourse. Water that has been diverted for irrigation may contain high levels of dissolved solids and pesticides that may in tern reduce the success of riparian species or favor undesirable species such as tamarisk. Pesticide use may also reduce the cuckoo's prey base to the point that nesting success is limited (Halterman 1991).

River channelization, construction of levees close to the river, and riprap along the levees have fragmented riparian habitat along the Sacramento River. These practices have also disrupted the ecological processes that both renew and restore riparian and aquatic habitats (Halterman 1991). More than one-half of the Sacramento River's banks within the lowermost 194 miles of river have been riprapped over the last four decades (USFWS 2001). The result is that much of the River's remaining riparian habitat now occurs in the form of narrow disconnected linear patches, which are considered unsuitable for yellow-billed cuckoo nesting (USFWS 2001). Other factors to population declines may be due to the loss of continuous migration corridors along with the lack of patches of adequate size for nesting, and the species' inability to use highly isolated patches (Halterman 1991).

Occupied habitat is located approximately 20 miles northwest and west of the FERC Project Boundary in the Sacramento River Conservation Area. Documented sightings of yellow-billed cuckoo in the past 20 years within the Feather River floodplain are approximately 16 to 18 miles downriver from the FERC Project Boundary (CDFG 2004). However, many of the documented sightings within the past 20 years are within the Sacramento River corridor as close as 16 miles west of the FERC Project Boundary as well as documented sightings within riparian forests along Butte Creek 10 miles west of the FERC Project Boundary.

6.3.1.2 Habitat in the Action Area

Potentially suitable habitat occurs within the FERC Project Boundary Action Area. Potential suitable habitat was delineated using GIS. Based on the vegetation mapping conducted by DWR (DWR 2003), riparian habitat was selected by having a canopy closure of greater than 40 percent with a sufficient shrub understory in blocks of 25 acres or greater and with at least a 300-foot width. A total of 1,218 acres are mapped as potential suitable habitat. However, once field surveys were conducted in the delineated habitat it was evident that this acreage is an overestimation based on the lack of suitable shrub understory. Potential suitable habitat for the yellow-billed cuckoo is shown on Figure 6.3-1.

Habitat Types and Use Patterns

The yellow-billed cuckoo requires 50 to 60 acres of multi-story riparian forest habitat to breed and enough room for dispersal area so birds can establish their territory for future

breeding (Laymon in CPIF Website). Upland foraging areas where the birds can feed on katydids and sphinx moth larvae are necessary.

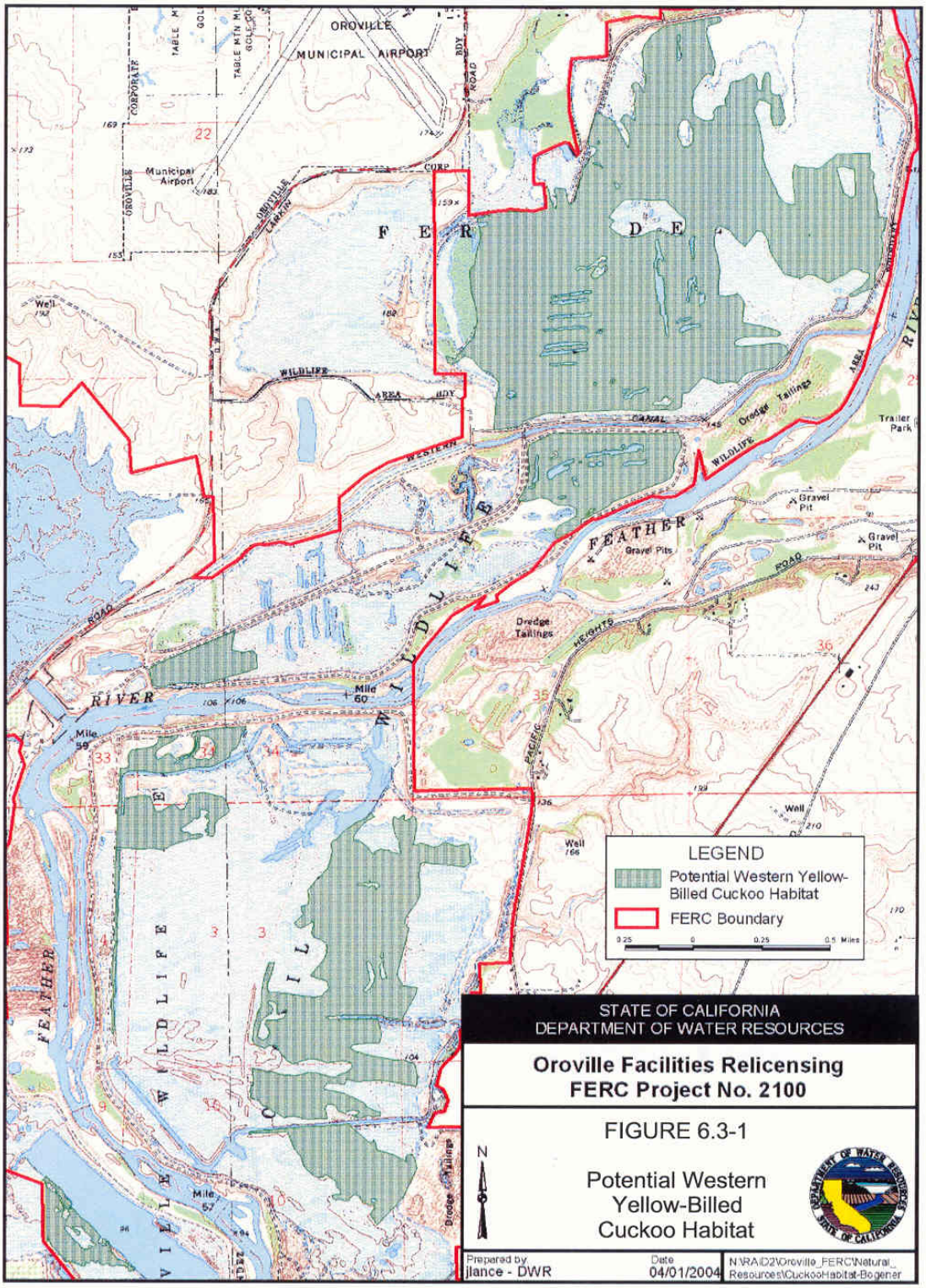

Figure 6.3-1. Potential Western Yellow-Billed Cuckoo Habitat

Habitat Designations

No critical habitat is established for Candidate species. However, the breeding population west of the FERC Project Boundary Action Area in the Sacramento River area has been the product of restoration efforts, which apparently are succeeding in expanding breeding habitat for the yellow-billed cuckoo in other areas of California (TNC Website). A cooperative effort between the Nature Conservancy, USFWS, CDFG, other agencies, and local landowners such as farmers are carrying out one of the largest riparian restoration projects in the U.S. just 18 miles west of the Action Area along a large reach of the Sacramento River (TNC Website).

Habitat Quantity and Quality

The contiguous riparian forest within the OWA providing potential suitable habitat totals 1,218 acres. Sufficient water for humidity exists at some locations within the OWA but the riparian habitat is nearly even aged and does not provide the multi-storied tree and dense willow/riparian shrub understory apparently necessary for successful breeding territories. Some of the habitat components do exist within the FERC Project Boundary Action Area but as of yet do not coincide to provide suitable nesting habitat.

6.3.1.3 Survey Methods and Results for Action Area

Methods

Areas within the OWA that were selected as potential cuckoo habitat (Figure 6.3.1) were surveyed one time during the breeding season (July) using recorded cuckoo calls. The surveyors broadcast the prerecorded call then listened for response calls. Three call/listen cycles were repeated at 100-yard calling distances within each block. Surveys were conducted during the July 2002 and 2003 breeding seasons (DWR 2003).

Results

No yellow-billed cuckoos were located during surveys in 2002 and 2003 breeding season. Small blocks of potentially suitable habitat were located within the FERC Project Boundary, but these blocks do not approach the 50 to 60 acres of multi-story riparian forest habitat considered necessary to support breeding and dispersal of yellow-billed cuckoos

6.3.2 Mountain Yellow-Legged Frog

6.3.2.1 Biology and Ecology

The mountain yellow legged frog (*Rana muscosa)* is a montane species, which historically occurred in the Sierra Nevada Mountains at elevations ranging from 4,500 feet to over 12,000 feet but primarily above 5,940 feet. Its current range includes the Sierra Nevada Mountains from the vicinity of La Porte in southern Plumas County southward to Taylor and French Joe Meadows in southern Tulare County and portions of Nevada near Lake Tahoe (CDFG Website).

Habitat for the mountain yellow-legged frog includes streams, lakes, and ponds in montane riparian, lodgepole pine, subalpine conifer, and wet meadow habitat types (CDFG Website). This species appears to be absent from the smaller creeks, probably because these habitats do not have sufficient depth for adequate refuge and overwintering. Although this species can occur in low numbers along a variety of shorelines, it appears to prefer open stream and lake margins that gently slope up to a depth of 12 to 20 inches. These shorelines are probably essential for breeding and thermoregulation of larvae and adults, and may also provide shelter from predation (CDFG Website). Typical home ranges for this species are probably less than 33 feet from water. Occasional movements up to 165 feet may be associated with habitat deterioration, especially drying of lakes or streams (CDFG Website).

This diurnal frog emerges from overwintering sites immediately following snowmelt (CDFG Website). Breeding typically begins in April at lower elevations and June or July at upper elevations (67 FR 44382).

Breeding typically occurs in shallow water with the egg mass of up to 500 eggs (but usually 200 to 300) attached to gravel or rocks (CDFG Website). Breeding is season-dependent on altitude and weather conditions, March to May in the lower altitudes and from June to August at the higher elevations. Reproduction does not occur until after ice has melted from streams and lakes (CDFG Website). Larvae must overwinter up to two times for six to nine month intervals before attaining metamorphosis because the active season is short and the aquatic habitat maintains warm temperatures for only brief intervals (67 FR 44382-44392). Larvae are able to survive anoxic conditions when shallow lakes freeze to the bottom for months (CDFG Website). The time required to develop from fertilization to metamorphosis is believed to vary between one and two and a half years.

Activity patterns of adult frogs include basking in the sun or in warmer waters along the shoreline to maintain a constant body temperature (CDFG Website). Frogs usually crouch on rocks or clumps of grass within a few feet of water and dive into water, take refuge under rocks when disturbed, or rest exposed on the bottom. Significant seasonal movements or migrations have not been reported (CDFG Website). During winter, adults apparently hibernate beneath ice-covered streams, lakes, and ponds (CDFG Website). Frogs must hibernate in water, probably due to a limited toleration of dehydration (CDFG Website).

The adult frog diet consists of aquatic and terrestrial invertebrates (CDFG Website). Tadpoles feed on algae and diatoms along the rocky bottom in shallow water. When disturbed, adults dive into water to take refuge under rocks, or rest exposed on the bottom. During dry conditions they may enter rodent burrows near water.

Nonnative predators such as introduced trout and bullfrogs (*Rana catesbeiana)* prey extensively on mountain yellow-legged frog adults and tadpoles (67 FR 44382; USFWS 2002). Other predators include coyotes (*Canis latrans*), and western terrestrial garter snakes (*Thamnophsis elegans)* as well as introduced predatory fish (CDFG Website).

It is unknown how much of the mountain yellow-legged frog historical range in the Sierra Nevada has disappeared, but several indications suggest that the extent of disappearance is significant. Introduced fishes have apparently eliminated the mountain yellow-legged frog from many lakes and streams (CDFG Website). Current range of the mountain yellow-legged frog includes elevations above 5,940 feet from Plumas County south to Tulare County. A population is also recorded in Butte County. This population is separated from the main Sierra population by the Feather River Canyon (CDFG 2004). Records show that there are no sightings of the mountain yellow-legged frog within 10 miles of the FERC Project Boundary (CDFG 2004)

6.3.2.2 Habitat in the Action Area

Habitat for the mountain yellow-legged frog does not occur within the FERC Project Boundary based upon elevation distribution of this species.

6.4 PROPOSED THREATENED OR ENDANGERED WILDLIFE SPECIES

6.4.1 California Tiger Salamander

6.4.1.1 Biology and Ecology

The California tiger salamander (*Ambystoma californiense*) was proposed for listing as threatened on May 23, 2003 (68 FR 28647). The California tiger salamander was until recently considered a subspecies of *Ambystoma tigrinum* (*A. t. californiense*), but is now regarded as a separate species, *Ambystoma californiense (*68 FR 28647).

The California tiger salamander is a large, stocky, terrestrial salamander with a broad, rounded snout. Coloration consists of white or pale yellow spots or bars on a black background on the back and sides (USFWS Website). Adult males may reach a total length of 8.5 inches with females averaging about 6.5 inches (68 FR 28647). The California tiger salamander is a lowland species restricted to the grasslands and lowest foothill regions of Central and Northern California. Specifically, the California tiger salamander is restricted to large vernal pools, vernal playas, and large sag ponds in grassland and oak savannah plant communities from sea level to about 1,500 feet (68 FR 28647). Due to being poor burrowers, the California tiger salamander requires ground squirrel or other burrowing mammal holes for refugia in order to enter a dormant state during the dry months of the year, although man-made structures are also used. (USFWS Website).

California tiger salamanders require large contiguous areas of vernal pools containing multiple breeding ponds to ensure recolonization of individual ponds (USFWS Website). In addition to vernal pools, California tiger salamanders may use small artificial water bodies for breeding, such as stock ponds, which in some areas have replaced vernal pools. For example, 88 percent of the California tiger salamander population in Livermore Valley is located in stock ponds. Dry-season refuge sites within a reasonable distance of breeding sites (up to 1 mile) are likely a necessary habitat requirement since

this species is absent from areas with seemingly suitable breeding habitat but where surrounding hardpan soils lack small mammal burrows (68 FR 28647).

During years of low rainfall, California tiger salamanders may not reproduce (CDFG Website). During suitable years, females attach their eggs singly to twigs, grass, stems, vegetation, or debris after warm winter rains in November to February (CDFG 2004a). Soon after breeding, adults leave the pool habitat and return to the small mammal burrows, although they may continue to come out to feed nightly for an additional two weeks (68 FR 28647). Eggs are deposited singly or in small groups of two to four (although CDFG reports some females may lay over 1,000 eggs) on submerged and emergent vegetation in shallow pools. A minimum of about ten weeks is required to completed metamorphosis (CDFG Website).

Larvae feed on zooplankton, small crustaceans, and aquatic insects. Larger larvae have been known to consume smaller tadpoles of Pacific tree frogs (*Pseudacris regilla*) and California red-legged frogs (*Rana aurora draytoni*i). The larvae are considered a top predator in the seasonal vernal pools. Adult California tiger salamanders appear to be "sit-and-wait" predators, taking earthworms, snails, insects, fish, and even small mammals.

Mortality of juveniles during their first summer exceeds 50 percent (68 FR 28647). Lifetime reproductive success for tiger salamanders is low; the average female breeds 1.4 times and produces 8.5 young that survive to metamorphosis (68 FR 28647).

Adult salamanders move from subterranean refuge sites to breeding sites following relatively warm late winter and spring rains (CDGF Website) and usually at night. Some diurnal activity may occur during breeding. Adults may migrate up to 1 mile from upland sites to breeding ponds. Little movement occurs during the rest of the year. During breeding, males typically remain in the breeding ponds for six to eight weeks while females remain for one to two weeks (68 FR 28647).

This species is found in disjunctive remnant vernal pool complexes in Sonoma and Santa Barbara counties, in vernal pool complexes and isolated ponds scattered mainly along narrow strips of rangeland on each side of the Central Valley from southern Colusa Count south to northern Kern County, and in sag ponds and stock ponds in the coastal ranges from Suisun Bay south to the Temblor Range. Tiger salamanders are restricted to habitats in grasslands under 1,500-foot elevations where aquatic sites are available for breeding (USFWS Website). The only record of occurrence for the California tiger salamander in Butte County was at Gray Lodge Waterfowl Management Area where it has not been located since 1965 despite subsequent surveys (68 FR 28647; CDFG 2004).

The California tiger salamander has lost an estimated 75 percent of its habitat and there are approximately 150 known local populations of the salamanders (USFWS Website). No sightings are recorded within 10 miles of the FERC Project Boundary Action Area (CDFG 2004).

More recently, salamanders have only been recorded along the southern edge of Sacramento County (CDFG 2004). The factors restricting this species in the northern and southern edge of its range is speculative, but low rainfall and introduced non-native predators may be a cause (68 FR 287647).

The primary cause of the decline of California tiger salamander population is the loss and fragmentation of habitat from human activities and the encroachment of nonnative predators (USFWS Website). Loss of rain (vernal) pools, and specifically the degradation of complexes of long-lasting pools that are critical breeding habitat, is a significant threat to the California tiger salamander, especially with the continued fragmentation of known breeding sites (CDFG Website). Bullfrogs, Louisiana swamp crayfish mosquito fish (*Gambsia affinis*), green sunfish (*Lepomis cynellus*), and other introduced fish prey on adult or larval salamanders (USFWS Website). Reduction of ground squirrel populations, use of pesticides, non-native subspecies of salamander and automobiles also account for the decline of the population.

6.4.1.2 Habitat in the Action Area

Potentially suitable habitat occurs within the FERC Project Boundary Action Area for California tiger salamander in association with natural and man-made vernal pool habitat and adjacent upland areas. These vernal pool habitats occur in the Thermalito Afterbay and Thermalito Forebay in complexes in areas of hummocky ground on terrace-alluvial derived Redding soils (DWR 2004). DWR mapped 18.3 acres of vernal pool habitat. These natural pools range in size from very small (< 3 feet in diameter) to larger pools of nearly 4 acres. Multipool complexes within the area cover between 0.5 and 5 acres. The majority of pools are fairly shallow, although large deep pools also occur. These vernal pools support numerous vernal pool plant species (DWR 2004).

6.4.1.3 Survey Methods and Results for the Action Area

Methods

Based on input from USF&WS and CDFG staff during study plan development during relicensing, protocol level surveys for California tiger salamander were not conducted during the relicensing studies, nor were presence or absence surveys conducted.

Field surveys have focused on identifying vernal pools that could serve as breeding habitat within the Project Area and associated plant species. Vernal pools were mapped during vegetation/habitat surveys as described in Section 6.2.1.3.

Results

Based on vernal pool habitat mapping, and since California tiger salamanders are known to use stock ponds as well as vernal pools to breed, it is possible that habitats within a 1-mile radius of stock ponds, vernal pools, and other potential water sources within the FERC Project Boundary could be considered potentially suitable habitat for adults. However, there never have been any records of occurrence for the FERC

Project Boundary Action Area (CDFG 2004). The only record of occurrence in Butte County was for a sighting at Gray Lodge Wildlife Management Area approximately 40 miles from the FERC Project Boundary, and subsequent surveys since 1965 have not recorded the presence of the species. (CDFG 2004).

6.5 THREATENED PLANT SPECIES

Information on threatened and endangered plant species that have potential to occur in the Action Area were compiled from rare plant descriptions and distributions obtained from CNDDB records (CDFG 2002), a review of the California Native Plant Society's Inventory (CNPS 2001), *Manual of the Vascular Plants of Butte County California* (Oswald 1994), *The Jepson Manual* (Hickman 1993), other State and/or County biological survey records, web based and printed articles and discussions with local authorities. The California State University Chico (CSUC) Biological Sciences Herbarium database was queried for local habitat and range information (CSUC Website). Photographs and keys to species identification were taken from a CD-ROM program on *Vernal Pool Plants of the Northern Sacramento Valley* by Schlising and Warren (1999). Reference material was produced each month for field personnel using a CD-ROM program with photographs of *Selected Plants of Northern California and Adjacent Nevada* by Oswald (2002). Aerial photographs, soils maps, and vegetation maps (DWR 2003) were used to predict special status species plant habitats within the Action Area. Field maps were produced from blown up aerial photographs and topographic maps.

Botanical surveys were conducted in a manner that emphasized all potential habitat for the target threatened and endangered plant species (i.e., vernal pools/valley grasslands and serpentinitic/gabbroic soils). The survey area included all grassland habitats around the Thermalito Complex and all serpentine outcrops and adjacent areas. Gabbro soils were not identified in the Action Area prior to the 2002/2003 surveys. Early in 2004, it was discovered that approximately 64 acres of gabbro and gabbro-derived soils occur in the Action Area. This area will be surveyed in 2004.

Known occurrences of vernal pool listed species were visited to determine phenological stage and to familiarize botanists with species and micro-habitat. Surveys were conducted during the time of year when the target species were identifiable. The survey also focused on areas where project impacts are likely to occur and within 150 feet of all project facilities (see Figures 6.5-1, 6.5-1a, 6.5-1b and 6.5-1c).

In 2002, surveys were conducted on 7 days between June 30 and September 17 resulting in a total of 10 person-days in the field. In 2003, surveys were conducted on 91 days between March 12 and October 8 resulting in a total of 184 person-days in the field.

6.5.1 Slender Orcutt grass

6.5.1.1 Biology and Ecology

Slender Orcutt grass (*Orcuttia tenuis*) is an annual species with one or more erect stems from 3 to 6 inches in height (Nakamura and Nelson 2001). The leaves and stems form a weakly tufted plant. The inflorescence and foliage are often covered with sticky, fragrant secretions. The five-toothed lemma, glandular flowering heads, and slender stems are diagnostic features for this species. The five teeth at the lemma tips are more or less equal in length. Seeds germinate and begin to grow while still submerged producing juvenile leaves and then floating leaves as water temperature rises. A symbiotic soil fungus is required for seed germination. Terrestrial leaves begin to form once the pool begins to dry out and plants continue to mature after the pool dries out. This species flowers from May to June or July, depending on elevation, and is best identified after it begins to flower and up until the spikelets fall apart later in the year. Slender Orcutt grass grows in vernal pool habitats at elevations ranging from 90 to 5,700 feet.

Slender Orcutt grass is known to occupy larger vernal pools and, to a lesser degree, reservoir shorelines and in river floodplains (Nakamura and Nelson 2001). The habitat for the Orcuttiae grasses (including slender Orcutt grass) is most often larger, deeper vernal pools with higher inundation duration and appropriate timing of dewatering and plant development during the growing season. Pool habitats that support this species are primarily present in annual grassland vegetation but also in open conifer- and sagebrush-dominated vegetation types.

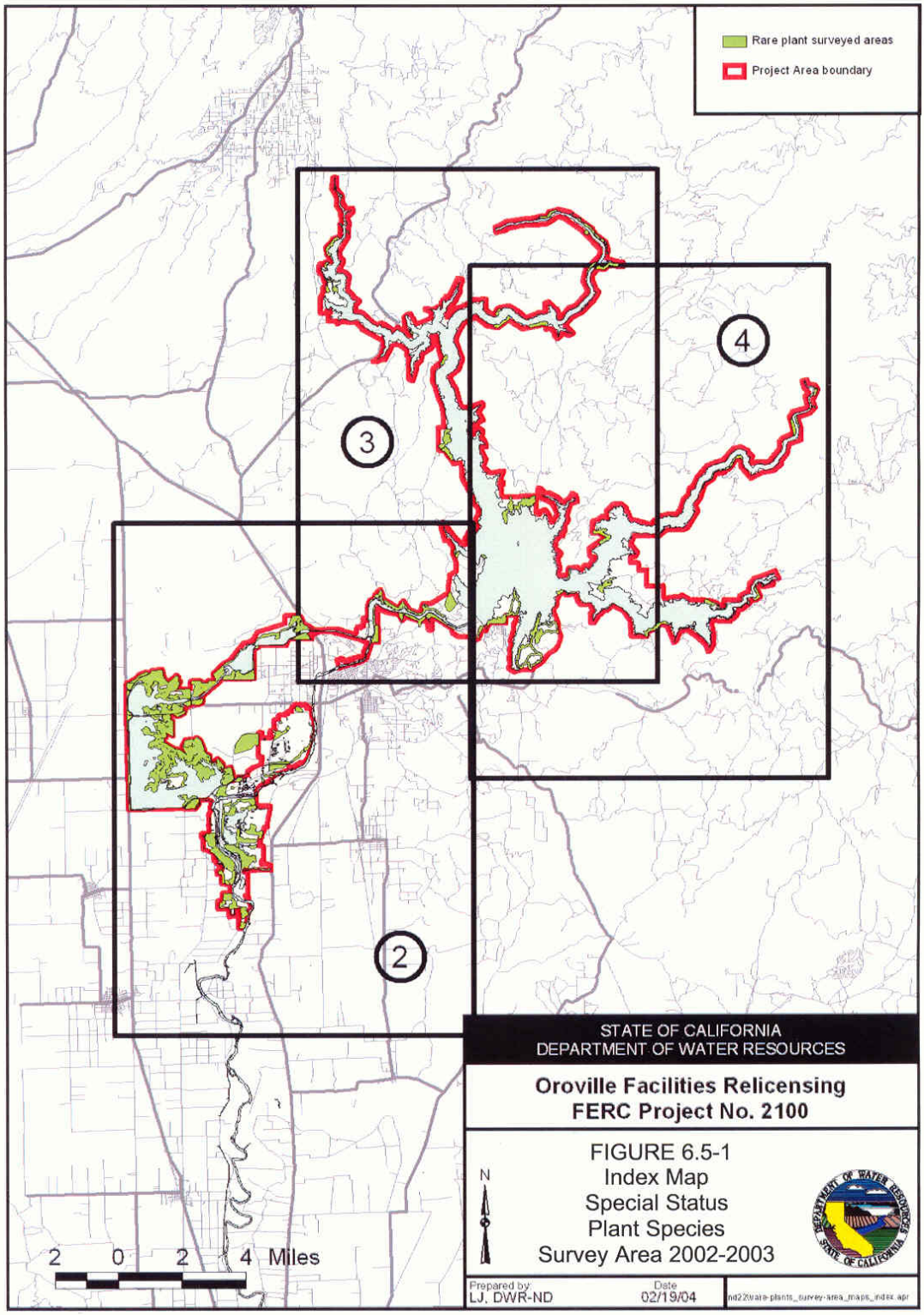

Figure 6.5-1. Index Map Special Status Plant Species Survey Area 2002/2003

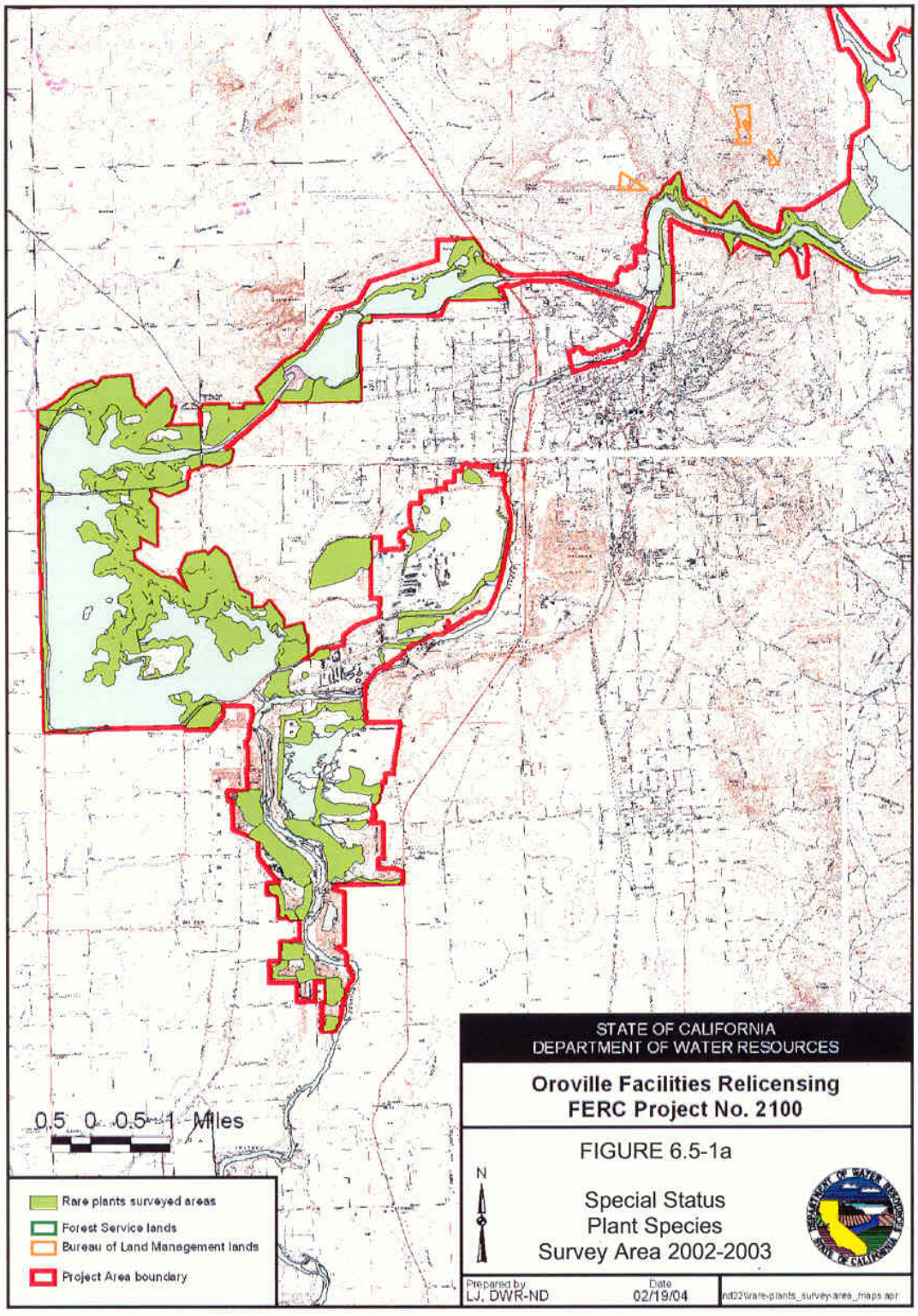

Figure 6.5-1a. Special Status Plant Species Survey Area 2002/2003

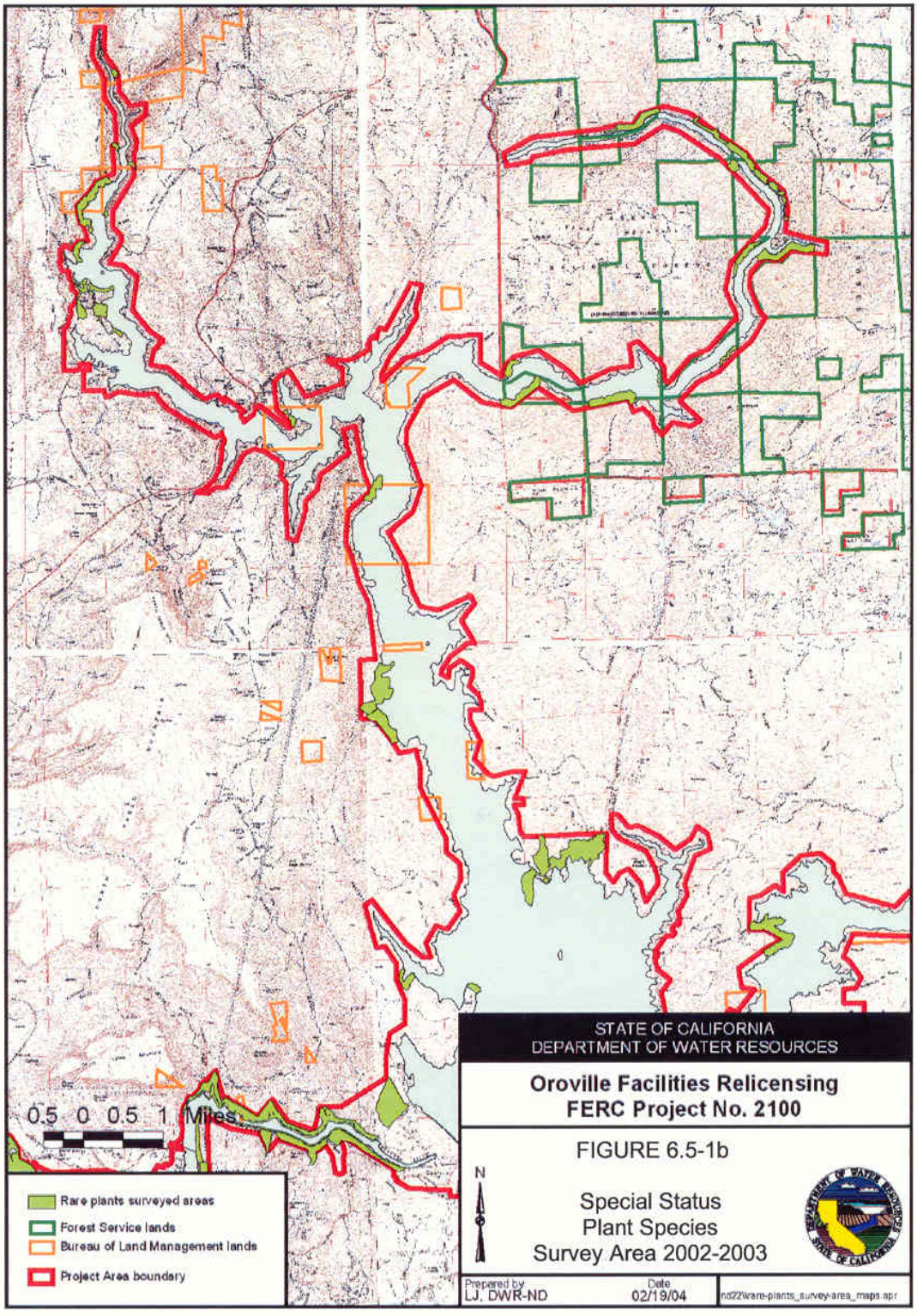

Figure 6.5-1b Special Status Plant Species Survey Area 2002/2003

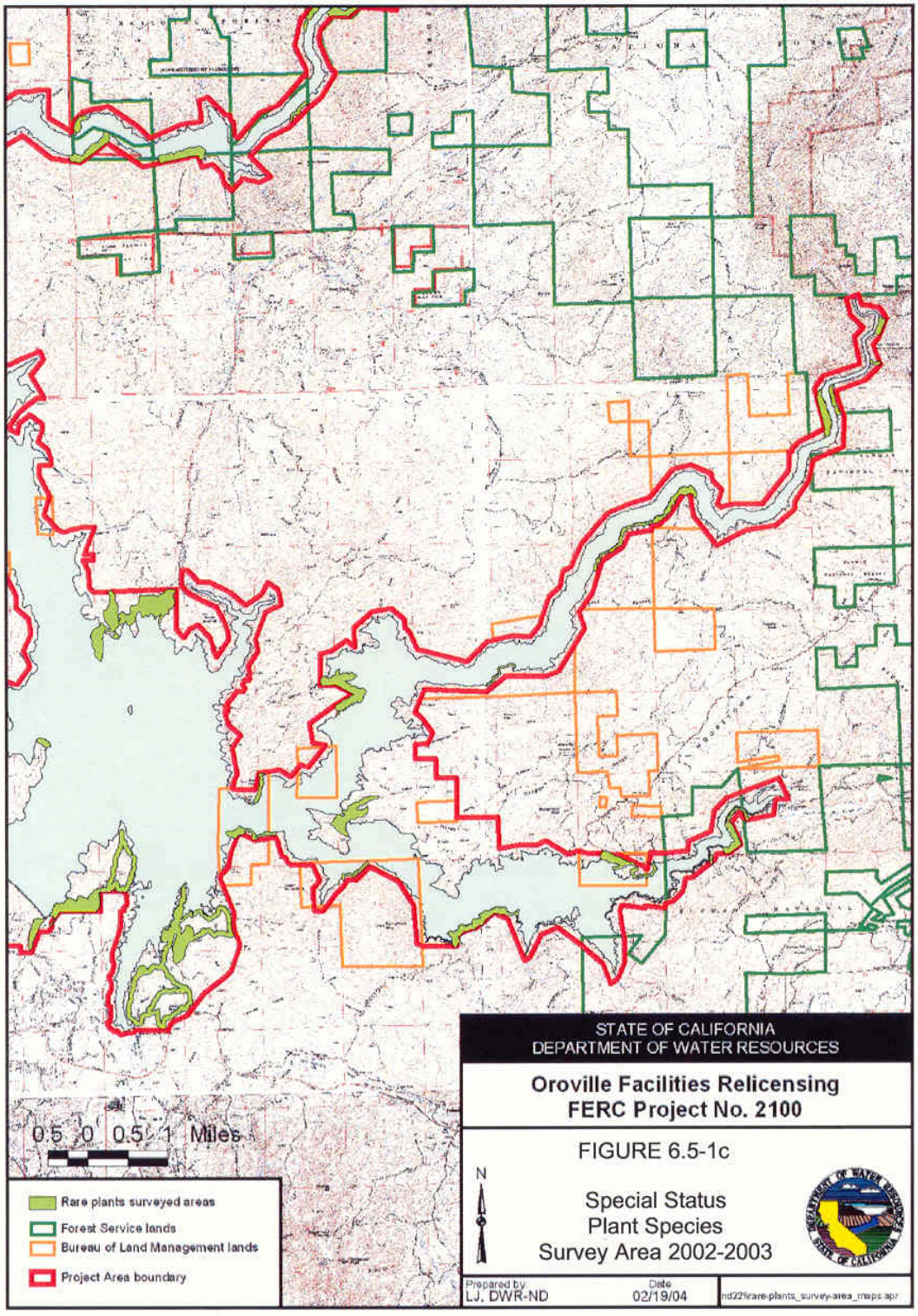

Figure 6.5-1c. Special Status Plant Species Survey Area 2002/2003

There are 78 known populations of the slender Orcutt grass distributed among 9 counties (Butte, Lake, Lassen, Modoc, Plumas, Sacramento, Shasta, Siskiyou, Tehama) in northern California (68 FR 46833 to 46867). ‘‘Although discoveries of additional populations in recent years have extended the known range of this species, the overall trend for slender Orcutt grass is one of decline as a result of habitat alteration and loss’’ (62FR 14338 to 14352). Conversion of vernal pool habitat to agricultural and urban uses is identified as the primary factor leading to the decline of this species, although other threats include highway expansion projects, disking, off-highway vehicle use, and competition from nonnative weeds (USFWS Website). Livestock grazing may or may not adversely affect this species, depending on types, season of use, grazing duration, and intensity (USFWS Website).

6.5.1.2 Habitat in the Action Area

Approximately 49 acres of vernal pools and swale complexes occur in the valley grassland vegetation types around the Thermalito Forebay and Thermalito Afterbay complex (see Figure 6.5-1a). The pools in this area are of the Northern Hardpan type and occur in areas of hummocky ground on terrace-alluvial derived Redding soils (CDFG 1998). Pools in this area range in size from very small (<3 feet in diameter) to larger pools of nearly an acre. Multi-pool complexes within the FERC Project Boundary cover between 0.5 and 5 acres. The larger, deeper pools were observed to be associated with clay soils that form a nearly impermeable pool bottom.

The larger pools were observed to support several downingias (*Downingia ornatissima*, *D. cuspidata* var. *cuspidata*, *D. bicornuta* var. *bicornuta*, *D. bella*), coyote thistle (*Eryngium castrense*), and the grasses including vernal pool foxtail (*Alopecurus saccatus*) and annual hairgrass (*Deschampsia danthoniodes*). There are several larger, deeper pools that are potential habitat for the summer-flowering listed slender Orcutt grass.

6.5.1.3 Survey Data for the Action Area

There are two known occurrences of slender Orcutt grass within 1 mile of the Action Area in the proximity of Oroville, California (CDFG 2004). No occurrences of this species were found within the Action Area during surveys conducted by DWR.

6.5.2 Hoover’s spurge

6.5.2.1 Biology and Ecology

Hoover’s spurge (*Chamaesyce hooveri*) is an annual, matt-forming species that grows on the bottom of drying vernal pools (Nakamura and Nelson 2001). The stems are brittle and exude milky latex when broken. The leaves on the prostrate branches have an opposite arrangement, toothed margins, and are round to kidney-shaped. The flowers are typical of the spurge family (Euphorbiaceae). The cyathium or miniature inflorescence mimics a single flower. The male and female flowers are surrounded by a cup-shaped involucre that bears four glands on the rim of the involucre and is subtended by deeply dissected white petal-like appendages. The diagnostic features

for this species are its opposite leaves that are toothed to the leaf base, prostrate habit, and deeply divided petal-like appendages more or less subtending 4 prominent glands on the rim of the involucre.

This species typically grows in the drying beds of larger, deeper pools (Nakamura and Nelson 2001). The longer inundation period associated with deeper pools results in lower cover of associated species that presumably provides less competition for the Hoover's spurge. Potential habitat for Hoover's spurge occurs in pools within the annual grassland vegetation types at elevations ranging from 80 to 820 feet elevation. The best identification period for this species is from late June to mid-September that correlates to its flowering period.

Currently, the CNDDB documents 30 occurrences of Hoover's spurge, four of which are presumed extirpated (CDFG 2004). The 26 extant occurrences are distributed along remnant alluvial terraces and fans, mostly along the eastern edge of the Great Central Valley in Tulare, Merced, Stanislaus, Butte, Glenn and Tehama counties, where it occurs below 820 feet elevation. The majority of occurrences are located near the Butte-Tehama county line in the northern Sacramento Valley.

6.5.2.2 Habitat in the Action Area

The potential habitat in the Action Area for Hoover's spurge is similar to the potential habitat described for slender Orcutt grass in Section 6.5.1.2. There are a few larger, deeper pools in the Action Area that could support Hoover's spurge based on DWR surveys.

6.5.2.3 Survey Data for the Action Area

One occurrence of Hoover's spurge is documented to occur within 10 miles of the Action Area generally southwest of the west branch Feather River arm of Lake Oroville and northeast of Oroville, California (CDFG 2004). No occurrences of Hoover's spurge were found within the Action Area during surveys conducted by DWR.

6.5.3 Layne's Ragwort

6.5.3.1 Biology and Ecology

Layne's ragwort (*Senecio layneae*) is a perennial herb arising from a short rootstock or caudex and has stems ranging from 1.5 feet to nearly 3 feet in height. The well-developed basal leaves are firm, more or less lanceolate in outline, and grow up to approximately 3.5 inches in length. The leaves on the stem become increasingly reduced in size higher up the stem. This species has from 5 to 10 narrow orange-yellow ray flower petals arranged in an irregularly spaced pattern around the head. The inflorescence is usually branched from near the top of the stem. Layne's ragwort is distinguished from other potentially co-occurring congeneric species by a combination of life form, type of flower, number of flower heads, flower color, and pubescence (USFWS 2002). This species flowers from April to July, which is the best period for easy field identification, and grows at elevations ranging from 600 to 3,000 feet.

Layne's ragwort grows on gabbroic and serpentinitic soils supporting chaparral, black oak and interior live oak vegetation types primarily in the vicinity of Pine Hill in western El Dorado County and the Red Hills of Tuolumne County. The Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada Foothills (USFWS 2002) includes the protection of Layne's ragwort. This recovery plan primarily focuses on the threatened and endangered species growing on the Pine Hill Formation in El Dorado County.

There are 43 records of Layne's ragwort identified in the CNDDB (CDFG 2004) from El Dorado, Tuolumne, and Yuba Counties. Four of these occurrences are thought to have been extirpated. Thirty-four of the remaining populations occur in El Dorado County. Two of the 43 records are in Yuba County. This species is most threatened by residential and commercial development, road maintenance, change in fire frequency, ORV use, and competition with nonnative vegetation, and is also threatened by urbanization in the vicinity on the Pine Hill formation (USFWS Website).

6.5.3.2 Habitat in the Action Area

There are approximately 172 acres of serpentine- and serpentine-derived soils in the Project Area (see Figures 6.5-1d, 6.5-1e, 6.5-1f). Numerous northwest to southeast trending bands of serpentine occur in the North Fork (87 acres) and West Branch (85 acres) arms of Lake Oroville. The dominant vegetation types associated with the serpentinitic substrates in the Action Area include Ponderosa pine-mixed oak woodlands and open foothill pine-mixed oak woodland, mixed chaparral and annual grassland. Some serpentine areas have been affected by historic logging and mining activities and an abandoned railroad bed. In other locations the wave action of the reservoir has undercut and eroded the adjacent slope. However, most of the serpentine-derived substrates are undisturbed. Approximately 64 acres of gabbro and gabbro-derived soils occur in the Project Area. These areas will be surveyed during 2004. This gabbroic intrusion is the same as that on which the nearest location of Layne's ragwort occurs. Serpentine- and gabbro-derived soils with sparse vegetation cover are potential habitat for the Layne's ragwort.

6.5.3.3 Survey Data for the Action Area

One population of Layne's ragwort occurs within 5 miles of the Action Area in Yuba County near Brownsville, California (CDFG 2004). Another occurrence is documented slightly more than 5 miles from the study area near the Brownsville Airport. No occurrences of Layne's ragwort were found within the Action Area during DWR surveys. Surveys will continue in 2004.

6.6 ENDANGERED PLANT SPECIES

The survey methodology for endangered plant species was discussed in Section 6.5.

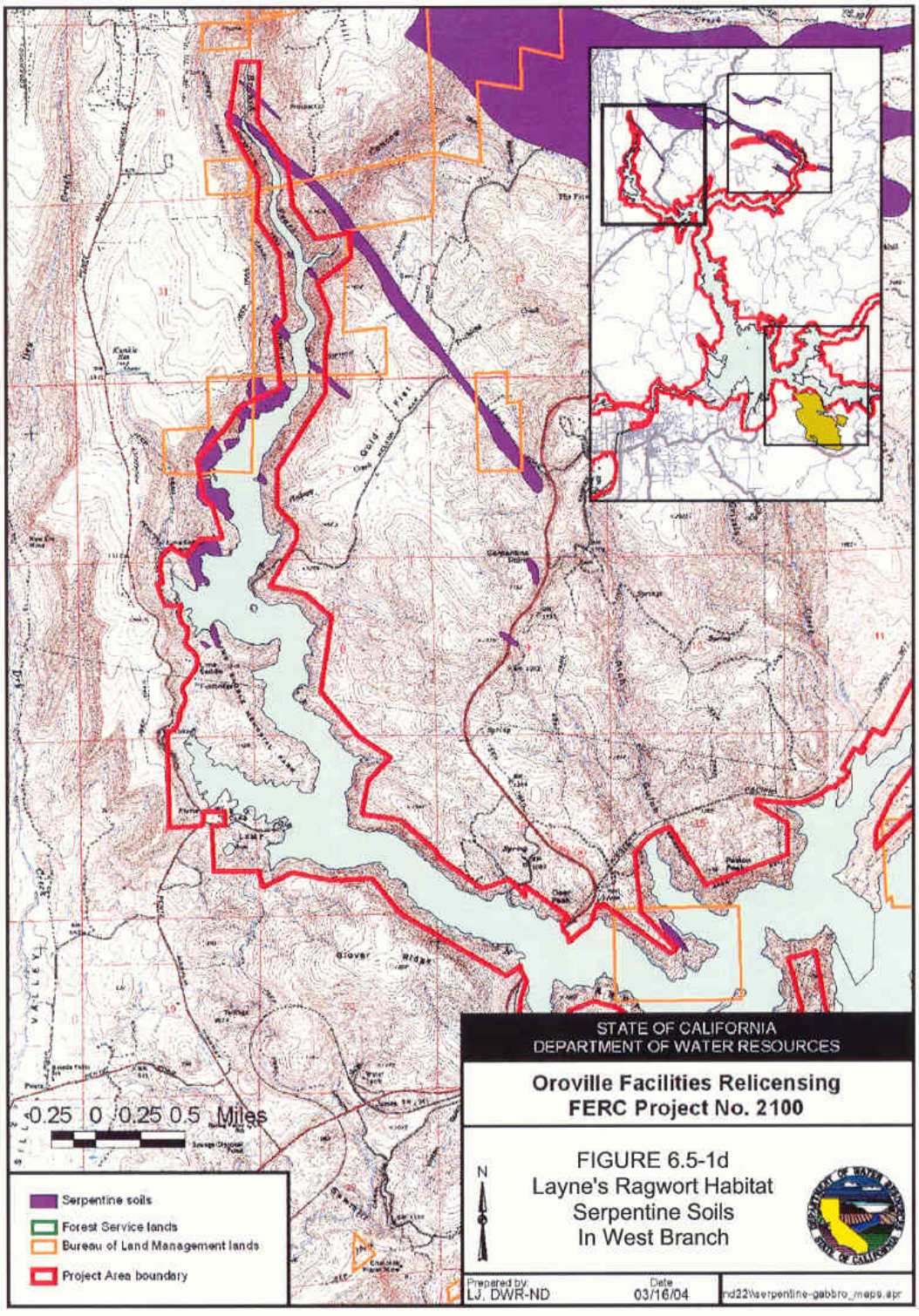

Figure 6.5-1d Layne's Ragwort Habitat Serpentine Soils in West Branch

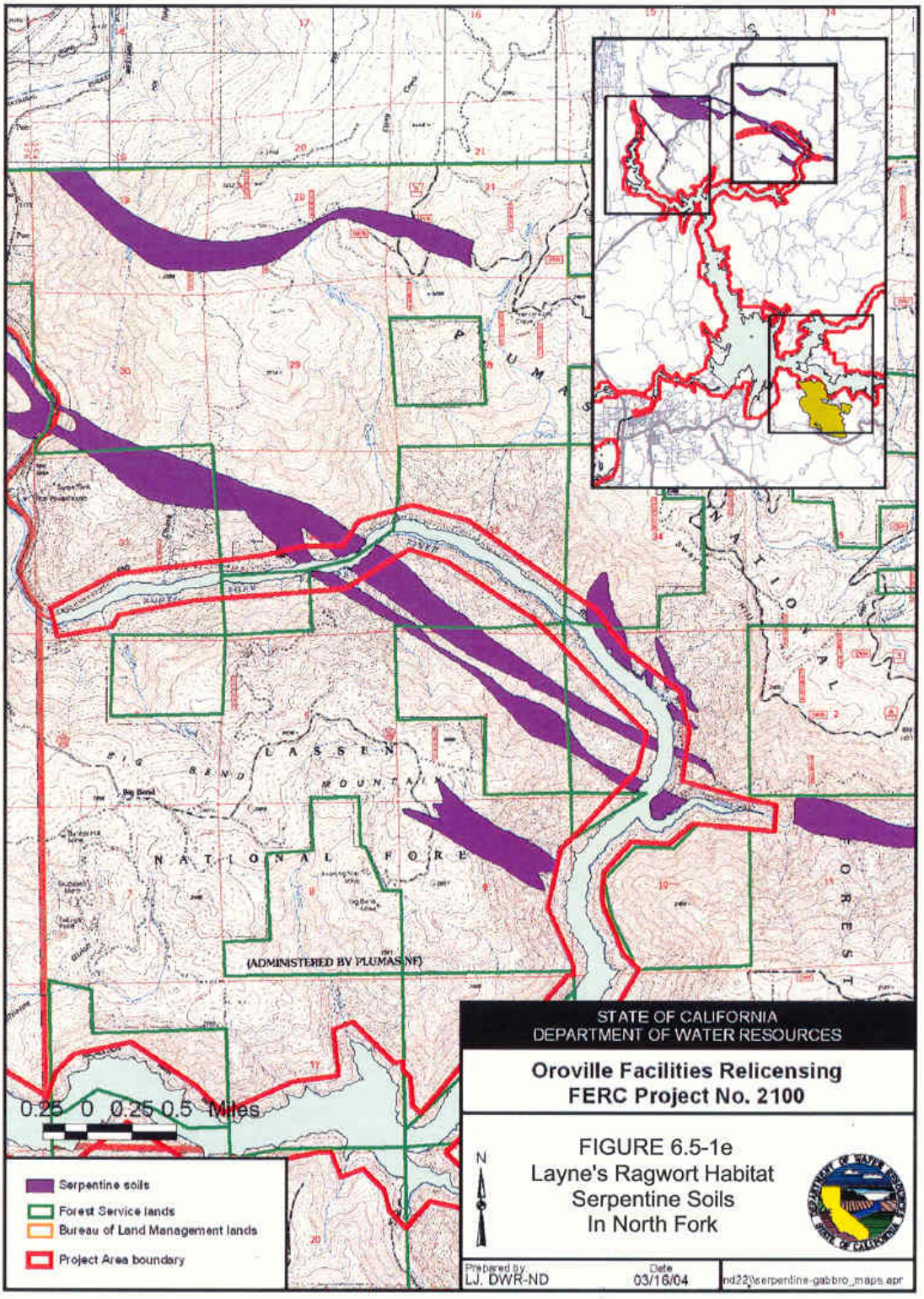

Figure 6.5-1e Layne's Ragwort Habitat Serpentine Soils in North Fork

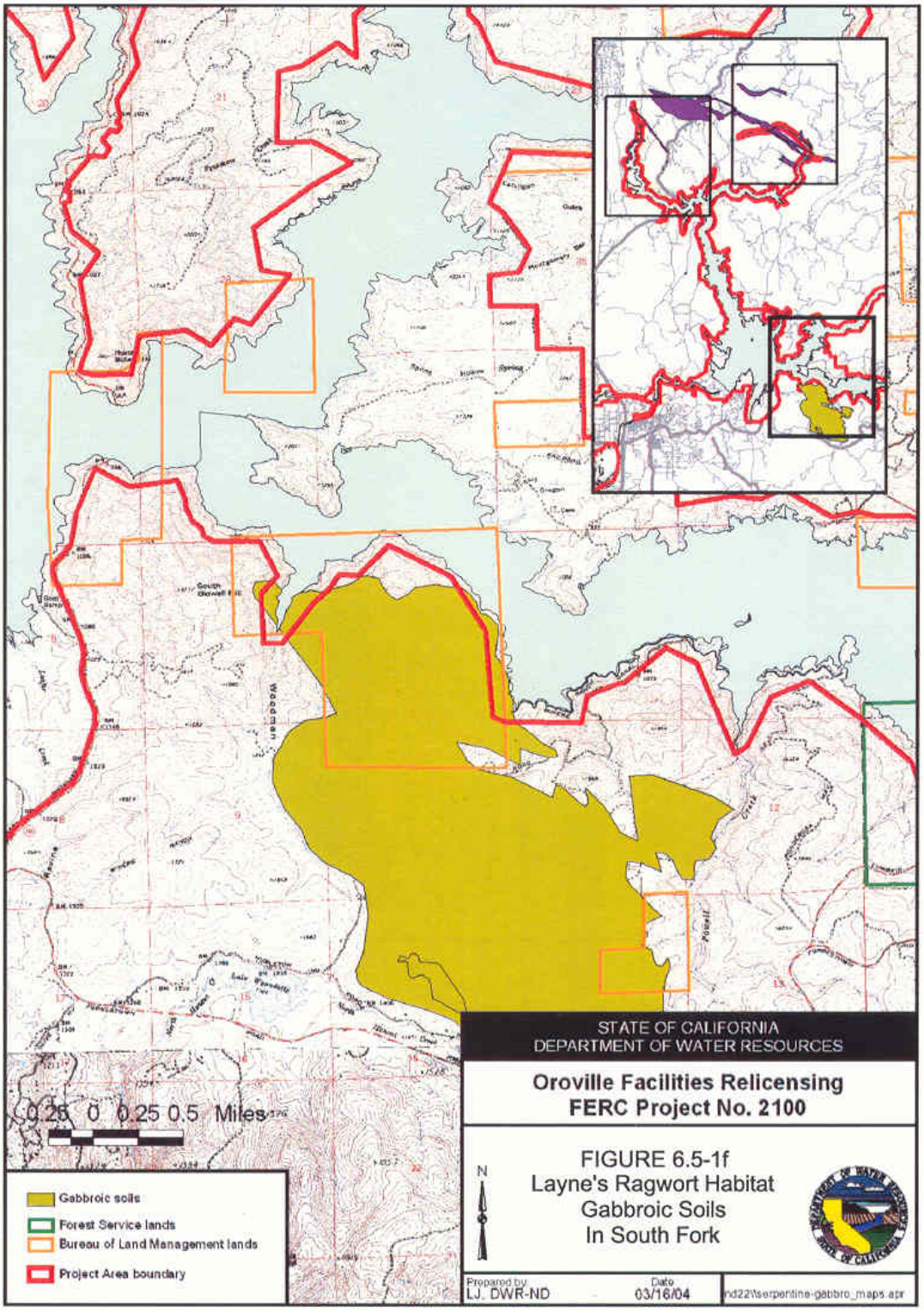

Figure 6.5-1f Layne's Ragwort Habitat Gabbroic Soils in South Fork

6.6.1 Butte County Meadowfoam

6.6.1.1 Biology and Ecology

Butte County meadowfoam is a winter annual with decumbent to ascending stem 1 to 10 inches in height and once-pinnate compound leaves with four to ten leaflets. This species has densely hairy foliage. The five flower petals are white with yellow veins and 0.33 to .5 inches in length and have two rows of hairs at the base of each petal (Nakamura and Nelson 1992). The petals equal or slightly exceed the sepals in length and are persistent, often curling over the mature nutlets. Each flower generally produces three to five nutlets that are covered with small rounded bumps (papillae) and cone-shaped projections (tubercles). Butte county meadow foam can be distinguished from other, sympatric, species of *Limnanthes* based on a variety of character traits, but it may require repeated surveys during the growing season to verify the plant's identity. The best identification period for Butte County meadowfoam is from March to early May during periods when plants are flowering and have produced mature fruit (Nakamura and Nelson 1992). The elevation range for this species is from 170 to 300 feet.

Butte County meadowfoam occupies ephemeral drainages, vernal pool depressions in ephemeral drainages, and occasionally occurs around the edges of isolated vernal pools.

6.6.1.2 Habitat in the Action Area

Approximately 77 acres of vernal pools and swale complexes occur in the valley grassland vegetation types around the Thermalito Forebay and Afterbay complex. The shallower pools and ephemeral depressions and drainages tend to have more permeable bottoms and a somewhat different assemblage of vernal pool species than the larger deeper pools.

Some of the most abundant species observed during the surveys were goldfields (several *Lasthenia* spp.), popcorn flowers (*Plagiobothrys stipitatus* var. *micranthus*, *P. greenei*), white flowered navarettia (*Navarettia leucocephala* ssp. *leucocephala*), Sacramento Valley pogogyne (*Pogogyne ziziphoroides*), and woolly marbles (*Psilocarphus* spp.). Widespread, less showy species included common toad rush (*Juncus bufonius* var. *bufonius*) and Leafy-bracted dwarf rush (*J. captitatus*). White meadowfoam (*Limnanthes alba* ssp. *alba*) is a common early inhabitant of ephemeral drainages and depressions within the Project Area. This species is closely related to the listed Butte County meadowfoam (*L. floccosa* ssp. *californica*), which occurs in similar habitat. The abundance of more ephemeral pools and swales is estimated to be more than 60 acres within the Action Area.

6.6.1.3 Survey Data for the Action Area

Sixteen of the eighteen remaining populations of Butte County meadowfoam occur on private land and are subject to urban development, agricultural land conversion, and highway widening or realignment (62 FR 14338 to 14352). There are four occurrence records for Butte County meadowfoam from approximately 5 miles north of the

Thermalito Afterbay in the vicinity of Shippee, California. There were no occurrences of this species found within the Action Area.

6.6.2 Hairy Orcutt Grass

6.6.2.1 Biology and Ecology

Hairy orcutt grass is a densely tufted annual species from 2 to 8 inches in height, with many stems (Nakamura and Nelson 2001). The stems and leaves are often densely hairy (pilose) and are covered with sticky, fragrant secretions. The inflorescence is characterized by a two-ranked arrangement of spikelets and increasing spikelet density higher up the rachis. The lemma has five teeth at the tip that are more or less equal in length. Seeds germinate and begin to grow while still submerged first producing rosettes of cylindrical juvenile then floating leaves as water temperature rises. Terrestrial leaves have broader flat leaves that begin to form once the pool begins to dry out and plants continue to mature after the pool dries out. This species flowers from May to July and is best identified after it begins flowering until the spikelets fall apart later in the year. Hairy Orcutt grass grows in vernal pool habitats at elevations ranging from 100 to 400 feet.

Hairy orcutt grass is known to grow on vernal pool bottoms and edges and is considered a late-season vernal pool species (Nakamura and Nelson 2001). The species is known to occur in both acidic and saline-alkaline soils, in vernal pool complexes with an iron-silica cemented hardpan or claypan in the annual grassland vegetation type.

6.6.2.2 Habitat in the Action Area

Approximately 77 acres of vernal pools and swale complexes occur in the valley grassland vegetation types around the Thermalito Forebay and Afterbay complex. The pools in this area are of the Northern Hardpan type and occur in areas of hummocky ground on terrace-alluvial derived Redding soils (CDFG 1998). Pools in this area range in size from very small (< 3 feet in diameter) to larger pools of nearly 4 acres. Multi-pool complexes within the Project Area cover between 0.5 and 5.0 acres. The larger, deeper pools were observed to be associated with clay soils that form a nearly impermeable pool bottom.

The larger pools were observed to support several downingias (*Downingia ornatissima*, *D. cuspidata* var. *cuspidata*, *D. bicornuta* var. *bicornuta*, *D. bella*), coyote thistle (*Eryngium castrense*), and the grasses vernal pool foxtail (*Alopecurus saccatus*) and annual hairgrass (*Deschampsia danthoniodes*). These pools are potential habitat for the summer-flowering listed hairy Orcutt grass (*Orcuttia pilosa*).

The abundance of larger pools in the Action Area is estimated at 17.2 acres based on protocol designed to map larger, more obvious vernal pools during the development of the Land Management Plan for the Protection of the Potential Habitats of Special Status Species of Fairy and Tadpole Shrimp.

6.6.2.3 Survey Data for the Action Area

Of the original 34 known populations of hairy Orcutt grass, 11 are thought to have been extirpated due to agricultural land conversion, urbanization, and intensive cattle grazing (62 FR14338 to 14352). One occurrence of hairy Orcutt grass is documented within 10 miles of the Action Area, generally southwest of the west branch Feather River arm of Lake Oroville and northeast of Oroville, California. No occurrences of hairy Orcutt grass were found within the Action Area.

6.6.3 Greene's Tuctoria

6.6.3.1 Biology and Ecology

Greene's tuctoria is an annual species that grows in tufts with multiple erect to decumbent stems 1 to 6 inches in length (Nakamura and Nelson 2001). This species lacks the sticky, fragrant secretions found in species of *Orcuttia*. This species has leaf morphology similar to species of *Orcuttia* but produces no floating, aquatic leaves. The cylindrical juvenile leaves develop when plants are still submerged and flattened terrestrial stem leaves begin to form as the pools dry out. The stems often have purplish pigmentation at the nodes and are sparsely covered with long, soft hairs. The arrangement of individual spikelets on the rachis gives the inflorescence a dense spike-like appearance. The inflorescence is often partially hidden by the upper stem leaf sheaths. The spikelets are spirally arranged on the rachis and the spiklelets have no glumes. The lemma tips are somewhat flattened and have seven to nine teeth; the central tooth is spine-tipped. This species flowers from May through July and is best identified after it begins flowering up until the spikelets fall apart later in the year.

Greene's tuctoria grows in the bottom of vernal pools at elevations ranging from 200 to 3,500 feet typically within the annual grassland vegetation type (Nakamura and Nelson 2001).

6.6.3.2 Habitat in the Action Area

Approximately 77 acres of vernal pools and swale complexes occur in the valley grassland vegetation types around the Thermalito Forebay and Afterbay complex. The pools in this area are of the Northern Hardpan type and occur in areas of hummocky ground on terrace-alluvial derived Redding soils (CDFG 1998). Pools in this area range in size from very small (< 3 feet in diameter) to larger pools of nearly 4 acres. Multi-pool complexes within the FERC Project Boundary cover between 0.5 and 5.0 acres. The larger, deeper pools were observed to be associated with clay soils that form a nearly impermeable pool bottom.

The larger pools were observed to support several downingias (*Downingia ornatissima*, *D. cuspidata* var. *cuspidata*, *D. bicornuta* var. *bicornuta*, *D. bella*), coyote thistle (*Eryngium castrense*), and the grasses vernal pool foxtail (*Alopecurus saccatus*) and annual hairgrass (*Deschampsia danthoniodes*). These pools are potential habitat for the summer-flowering listed Greene's tuctoria (*Tuctoria greenei*).

The abundance of larger pools in the Action Area is estimated at 17.2 acres based on protocol designed to map larger, more obvious vernal pools during the development of the Land Management Plan for the Protection of the Potential Habitats of Special Status Species of Fairy and Tadpole Shrimp.

6.6.3.3 Survey Data for the Action Area

Thirty-eight populations have been documented from Fresno to Shasta Counties. However, nineteen of these populations, from Fresno, Madera, Stanislaus, Tulare, and San Joaquin Counties, are thought to have been extirpated. The remaining populations occur in Butte, Glenn, Merced, Shasta, and Tehama Counties. All populations are on private lands except one population at the Sacramento National Wildlife Refuge. One occurrence of Greene's tuctoria is documented to occur within 10 miles of the Action Area generally southwest of the west branch Feather River arm of Lake Oroville and northeast of Oroville, California. A second Greene's tuctoria occurrence is located within 5 miles of the Action Area near Cottonwood Creek northeast of Oroville, California. A third occurrence of Greene's tuctoria is located within 1 mile of the Thermalito Afterbay near Richvale, California. No occurrences of Greene's tuctoria were found within the Action Area.

6.6.4 Hartweg's Golden Sunburst

6.6.4.1 Biology and Ecology

Hartweg's golden sunburst is an annual species with stems about 2 to 6 inches in height. Its leaves are alternately arranged along the stem and 0.4 to 0.8 inch in length. The outline of the leaf is narrow, entire with three blunt teeth at the apex or three-lobed. The foliage is often covered with white, wooly hairs. The bright yellow flower heads are solitary at the tips of the branches. The ray flower petals are equal in number to the phyllaries. Hartweg's golden sunburst can be distinguished from closely related species by having its largest leaves being entire or three-lobed versus once or twice pinnatifid. This species flowers in March and April and grows at approximately 400 feet elevation.

Hartweg's golden sunburst is strongly associated with Mima mound topography, specifically the north and northeast facing slopes of the mounds with relatively low cover of associated species (Stebbins 1991). Plants have also been found growing along shady creeks and the margins of vernal pools (CDFG 2002). Mima mounds that support this species generally occur in annual grassland and blue oak vegetation types growing in acidic soil types (Stebbins 1991).

6.6.4.2 Habitat in the Action Area

Approximately 77 acres of vernal pools and swale complexes occur in the valley grassland vegetation types around the Thermalito Forebay and Afterbay complex. The pools in this area are of the Northern Hardpan type and occur in areas of hummocky ground on terrace-alluvial derived Redding soils (CDFG 1998). The hummocky topography associated with vernal pool complexes in the Action Area were not considered to be potential habitat for the Hartweg's golden sunburst (*Pseudobahia*

bahifolia) due to the lack of well defined “Mima” mound topography, the absence of acidic soil types and the fact that the nearest known extant occurrence in the San Joaquin Valley. However, the flood plain along the Feather River downstream of the Thermalito Afterbay was surveyed and assessed for potential habitat due the historic occurrence (extirpated) of this species in the project vicinity. No potential habitat was observed during botanical surveys.

6.6.4.3 Survey Data for the Action Area

The type locality for Hartweg’s golden sunburst was historically known in Yuba County within 1,500 feet of the confluence of the Yuba and Feather Rivers. This type locality has been extirpated. Currently, this species is known from two general areas in the eastern San Joaquin Valley. Because the extirpated Yuba County occurrence was more than 26 miles south of the FERC Project Boundary, surveys for this species were not conducted within the Action Area. No plants were found downstream of Thermalito Afterbay along the Feather River floodplain.

7.0 EFFECTS OF THE PROPOSED ACTION

This section describes the direct and indirect effects of current Project Operation and Maintenance (O&M) and activities associated with Resource Actions (see Chapter 5.0, Description of Proposed Action) on threatened and endangered species potentially occurring in the Action Area. The specific locations, timing, and duration of activities associated with Resource Actions will not be known until Settlement is reached as part of the FERC Licensing process. Therefore, effects are evaluated programmatically for each activity. There is the potential over time for federally listed species not addressed in this document to occupy habitat within the Action Area. Should this occur, DWR will develop measures in association with USF&WS and the other resource agencies, as appropriate, to protect these individuals and their habitat.

7.1 SOUTHERN BALD EAGLE

Breeding territories for the southern bald eagle are currently limited to Lake Oroville, but this species forages on water bodies throughout the Action Area. The discussion of effects from activities associated with current O&M and activities associated with Resource Actions is restricted to locations within the Action Area that have habitats that are used by bald eagles.

7.1.1 Direct Effects

Direct effects of current Project O&M activities and activities associated with Resource Actions are described below for the bald eagle.

7.1.1.1 Current O&M Activities

The Pacific Bald Eagle Recovery Plan (USFWS 1986) lists numerous threats to the bald eagle in the Valley and Foothills Management Zone (Zone 27), which includes the Action Area. These threats include habitat loss, shooting, human disturbance, environmental contaminants, and electrocution. Potential effects of current Oroville Project O&M activities on bald eagles include (1) altered prey availability due to water management, (2) reduced or degraded nesting and perching habitat from hazardous tree removal, (3) temporary disturbance from human presence, and (4) collision with or electrocution by power lines. Effects from O&M activities are greatest near the Oroville Project facilities, roads, transmission lines, and existing recreation sites and trails. The following sections describe the effects in each Project geographic location, Lake Oroville, transmission line rights-of-way near the Thermalito Diversion Pool, Thermalito Forebay, Thermalito Afterbay, OWA and Lower Feather River.

Lake Oroville

None of the three bald eagle nesting territories are located in areas directly affected by current Project O&M activities. Long-term availability of suitable nesting habitat is dependent on forest management not controlled by DWR. Floating campsites located within eagle nest territories have been relocated outside of the territories. The existing

boat-in camps associated with the Project are located over 1 mile from the nests, so recreation and O&M activities at these campsites do not affect nesting habitat or behavior of nesting eagles. Existing recreational uses in the general vicinity of the nest territories on Lake Oroville include boat traffic, boat-in camps, and, in the case of the Potter Ravine territory, a hiking trail. Monitoring of the bald eagles has yielded no evidence of adverse effects caused by the human activity associated with boating and boat-in camps. Bald eagles have been observed foraging in close proximity to anglers and are successfully reproducing at the existing level of recreational activity.

Pedestrian traffic on the trail system located within 0.33 mile of the Potter Ravine nest has been documented to elicit some behavioral responses by bald eagles. This territory has fledged two young each year since its discovery in 2002. Restrictions on human activity within nest territories have been implemented by DWR during the nesting seasons.

During the late winter and spring, the lake is being filled. This period coincides with the nest initiation, egg laying, incubation, hatching, and early nestling periods. During these months, recreation use is at low levels and nesting eagles take advantage of the ample aquatic foraging areas on Lake Oroville within several miles of each nest. During the summer and fall, the annual draw down results in a widened, steep-sloped draw down zone that is devoid of water and vegetation. This unvegetated zone increases the distances that bald eagles must fly from perch trees to obtain prey (fish and waterfowl). Conversely, the lower water level may also serve to concentrate prey fish, making them more readily accessible to eagles. Because water surface elevation levels differ from year to year and vary among water year types, the foraging habitat may vary annually as well as seasonally. Although lower water levels may increase energy expenditures and alter forage patterns and behaviors, the effects of these changes on foraging success, productivity, and survival is unknown. Bureau of Reclamation data analyses of bald eagle production on Lake Shasta indicate that there is a positive correlation between bald eagle productivity and high spring/summer water surface elevations. Nesting eagles on Lake Oroville may be affected in a similar manner. However, insufficient data currently exist within the action area to evaluate the effects of reservoir water levels on bald eagle productivity.

Thermalito Complex and OWA

The Thermalito Complex (Thermalito Forebay and Thermalito Afterbay) and OWA are used regularly by small numbers of foraging bald eagles during the winter. These areas will continue to provide habitat for prey species including fish and wintering waterfowl. The ongoing gravel extraction operations in the OWA may limit eagle foraging and discourage use of the large cottonwood trees that may otherwise provide suitable nest or perch sites. Bald eagles may also be affected periodically from the use of herbicides and pesticides in adjacent habitats, and recreation and other human activity in the Thermalito Forebay and Afterbay areas. Use of chemicals to control weeds and pests could poison eagles that forage on rodents exposed to pesticides. The degree to which

pesticide use would affect bald eagles is dependent on the toxicity or bioaccumulation properties of the chemicals used.

Transmission Line Rights-of-Way

There are approximately 11.3 miles of 230 kV transmission lines within the FERC Project Boundary. Transmission line conductors are typically 7 to 30 feet apart, greater than the wingspan of any North American raptor (APLIC 1996). Thus, raptor electrocution by transmission lines is rare and is usually associated with birds nesting on the towers. A dangling prey item or piece of nesting material being delivered to the site can span the gap between conductors electrocuting the bird returning to the nest. The distribution lines associated with the Project are greater than the recommended 5-foot spacing (APLIC 1996). There are no records of bald eagles being electrocuted within or in the vicinity of the FERC Project Boundary.

The vertically configured Project transmission lines may represent a collision hazard to bald eagles. However, raptors are rarely reported as victims of wire collision and exhibit few of the characteristics that make some species more vulnerable to collisions with wires. Although they may fly at the level of power lines, raptors have excellent visual acuity and they are very maneuverable; their flight is relatively slow, and they do not fly in flocks (APLIC 1994). This risk is greatest, but still extremely low, at the Thermalito Diversion Pool where the lines are near the shoreline and in some cases cross over the water. There have been no documented cases of bald eagles being killed due to collision with the Project transmission lines.

Lower Feather River

Project O&M has no known adverse affects to suitable bald eagle habitat in the Feather River below the OWA.

7.1.1.2 Potential Activities Associated with Resource Actions

Resource Actions whose activities could have the greatest probability of affecting bald eagles include (1) fish passage enhancements; (2) the OWA Management Program; (3) the Thermalito Afterbay Wildlife Development; (4) lower river fish habitat improvements; (5) invasive plant species control; and (6) mechanical changes to the river channel. Each of these Resource Actions may include various activities that can affect bald eagles (see Chapter 5.0 for description of activities).

Implementation of Resource Actions that involve construction with heavy equipment (e.g., access improvements, fish barrier construction, irrigation system development, road and trail construction and maintenance, sign installation, and vegetation type conversion) may result in disturbance effects on bald eagles or modifications to their habitat. Human activity associated with construction as well as most other Resource Actions could also disturb bald eagles. The following sections describe the effects of activities associated with Resource Actions in each Project geographic location, Lake Oroville, Thermalito Complex—Thermalito Forebay, Thermalito Afterbay, and OWA.

Lake Oroville

Activities associated with Resource Actions at Lake Oroville that could potentially affect bald eagles include periodic invasive plant species control and fish habitat enhancements. The invasive species control program may periodically increase human activity near bald eagle nest or forage sites, causing temporary disturbance. Scheduling weed abatement activities near the nest territories between August and December can minimize impacts. Fish habitat enhancements could provide improved prey concentration and availability for bald eagles. Annually adding fish structure and cover in the reservoir within the secondary foraging zones around active nesting territories would enhance eagle foraging conditions. Similarly, proposed enhancements for fish passage and salmonid habitat may improve foraging for bald eagles.

None of the proposed future recreational enhancements are located near the existing bald eagle nesting territories or primary foraging zones and are therefore not likely to adversely affect the species. Future development could further reduce the amount of habitat available for additional nesting territories.

Thermalito Complex and OWA

Potential impacts to bald eagles from activities associated with Resource Actions at the Thermalito Complex and OWA would be minimal due to the low level of eagle activity in these areas. The Wildlife Habitat Development Program would result in some habitat manipulation and periodic human activity, which may temporarily displace foraging bald eagles. Since there are other foraging areas available nearby, these activities are not likely to cause much additional energy expenditure for bald eagles. Construction of four new brood ponds in the Thermalito Afterbay area could be expected to improve fish and waterfowl habitat, possibly increasing prey availability for wintering bald eagles. Noxious weed treatment and replanting will likely occur periodically, possibly resulting in minor disturbance to eagles in the area.

7.1.2 Indirect Effects

Indirect effects on the bald eagle from activities associated with Project O&M and Resource Actions are described below.

7.1.2.1 Current O&M Activities

Over the long term, indirect effects to bald eagles are possible if O&M activities change. However, at this time, the discussion of direct effects on prey availability, nesting habitat, perching habitat, and disturbance in Section 7.1.1.1 likely encompasses the range of possible effects. None of the major Project O&M activities is located within 0.5-mile of any nest site and foraging eagles appear to tolerate the existing level of noise and disturbance in the FERC Project Boundary

7.1.2.2 Potential Activities Associated with Resource Actions

Activities associated with Resource Actions are not likely to cause any indirect adverse effects beyond the minor habitat modification and short-term disturbances discussed above. If recreational activity significantly increases on Lake Oroville, it is possible that additional adverse indirect effects to the three nesting pairs (and any additional pairs that may become resident in the future) could occur due to increased disturbance. However, the visual screening between the nests and the lake can minimize water-based human disturbance effects.

7.1.3 Other Consultations and Effects on Critical Habitats

Critical bald eagle habitat does not occur within the Action Area.

7.1.4 Mitigation and Enhancement Measures

Minimization, conservation, and enhancement measures for the bald eagle have been developed by DWR in consultation with USF&WS and CDF&G and are described in Section 5.5.1. These measures will be implemented by DWR under the current Project license and will therefore cover activities associated with existing Project O&M, as well as the Resource Actions. Implementation of these measures would be expected to reduce or eliminate the effects of any activities potentially disturbing bald eagles or their habitats.

7.1.4.1 Avoidance Measures

DWR has prepared maps showing the primary and secondary zones around each bald eagle nest as part of the site-specific management plans. These maps will be used to direct activities associated with Project O&M or proposed Resource Actions away from eagle nests to avoid impacts. The DWR will work with the other agencies to enforce habitat protection measures and seasonal closures to minimize the risk of nest failure from human disturbance in these areas. DWR will ensure that activities related to all Resource Actions implemented would also benefit bald eagle habitat (e.g., riparian perching habitat) to the extent practicable. Activities associated with removal of noxious weeds and aquatic primrose will be closely planned, directed, and monitored to ensure protection of potential bald eagle perching and foraging habitat and to minimize disturbance during the most sensitive time periods.

7.1.4.2 Conservation Measures

DWR will implement four measures directly related to conserving bald eagles and their habitat. These include (1) site-specific nesting territory management plans, (2) enhancement of fish habitat in reservoirs, (3) annual interagency meetings to coordinate bald eagle management, and (4) periodic mid-winter surveys of the Action Area (Chapter 5, Description of Proposed Action). The nesting territory management plans will specifically protect habitat for long-term eagle nesting and will minimize the level of human activity within close proximity of the nests. In conjunction with the nest site plans, DWR will implement, if feasible, measures to enhance fish resources in Lake

Oroville. Annual coordination with agencies, monitoring bald eagle use and productivity, and participation in the mid-winter surveys will aid in identifying the need for adaptive management in the future.

7.1.4.3 Mitigation Measures

Conservation measures included in the Proposed Action will avoid, and/or minimize direct and indirect impacts from current Project O&M and activities associated with Resource Actions.

7.1.4.4 Enhancement Measures

Conservation measures and activities associated with several Resource Actions are expected to enhance nesting, perching, and foraging habitat in various parts of the Action Area.

7.2 GIANT GARTER SNAKE AND CALIFORNIA RED-LEGGED FROG

The giant garter snake potentially occurs in suitable habitat that is found scattered throughout the Action Area, except near Lake Oroville. The California red-legged frog is likely limited to tributaries of Lake Oroville and wetlands and ponds. Habitat characteristics important to giant garter snake and California red-legged frog are quite similar, and there is substantial overlap in the potentially suitable habitat for these two species within the Action Area. Thus, activities associated with Project O&M and proposed Resource Actions are considered to affect both species, and the discussion is combined in this section, except where noted.

7.2.1 Direct Effects

The following sections describe the direct effects of current Project O&M activities and activities associated with Resource Actions for the giant garter snake and California red-legged frog.

7.2.1.1 Current O&M Activities

The recovery plans for the giant garter snake (Miller and Hornaday 1999) and California red-legged frog (USFWS 2002) indicate that there are many threats to these species. Habitat loss and fragmentation, flood control activities, changes in agricultural and land management practices, predation from introduced species, parasites, water pollution, and continuing threats are the main ones listed. Potential effects of current Project O&M activities on these species include (1) degradation of habitat due to water level fluctuations; (2) trampling and removal of vegetation incidental to maintenance and recreation; (3) direct mortality from ground disturbing maintenance activities, vehicular traffic, and purposeful killing by recreationists; (5) reduction in food resources due to alteration of habitat or application of herbicides and pesticides; and (6) toxicity from environmental contaminants; (7) disturbance/displacement through recreational activity; (8) high water velocities; (9) possible entrainment; and (10) colder water temperatures .

Direct mortality of the giant garter snake from ground disturbing activities is most likely to occur between 1 October and 1 May when snakes are generally less active. Use of herbicides and pesticides for O&M activities could adversely affect the quality and quantity of habitat for both the garter snake and red-legged frog if it is not carefully selected and applied. These chemicals could adversely affect habitat structure and extent by altering vegetation growth and could affect food supply by killing prey. Exposure to the chemicals through either the water or digestion of prey can result in direct effects to both species, including mortality. The presence of predatory, non-native bullfrogs in the Action Area impoundments will also continue to be a source of potential mortality of both species. The following sections describe the Project O&M effects in each Project geographic location, Lake Oroville, Thermalito Complex (Thermalito Forebay and Thermalito Afterbay), OWA and Lower Feather River.

Lake Oroville

The steep-sided shorelines and draw down zones of Lake Oroville do not provide habitat for California red-legged frog and giant garter snake. Natural impassable barriers to predatory fish exist near the mouth of French Creek and prevent non-native fish species from ascending French Creek to the area of the remnant California red-legged frog population. Therefore, Project O&M for this geographic area will not affect either species. The California red-legged frog may be present in some of the streams in the watershed above Lake Oroville, but Project O&M does not affect these areas.

Thermalito Complex and OWA

Current Project operations affect potential habitat for the giant garter snake and California red-legged frog through water level fluctuations in the Thermalito Complex, particularly at the north end of the Thermalito Forebay and at the southern portion of the Thermalito Afterbay. Weekly average water level changes in the Thermalito Afterbay range up to about 4.8 feet (based on historical data) and occur year-round during power generation. These fluctuations cause changes in the stability and character of habitat adjacent to the Thermalito Forebay and Thermalito Afterbay by exposing large expanses of mud flats, thereby isolating aquatic foraging habitat from emergent and upland vegetative cover. These changes increase the distance between forage and escape cover and potentially increase the risk of predation. Elevated water levels also inundate exposed shoreline basking habitat and potentially flood rodent burrows used by both the garter snake and red-legged frog for escape cover. Frequent water level fluctuations decrease available food supplies, and escape refugia for both species. Inundation of rodent burrows also may trap individuals below ground causing direct mortality through drowning.

Existing recreation within the Thermalito Complex and OWA may degrade giant garter snake/California red-legged frog habitat. High speed motorized boat use of the Thermalito Afterbay impacts giant garter snake/California red-legged frog shoreline habitat by increased wave action. Temporary impacts to the habitat of these species from recreational activities include trampling of vegetation, crushing of rodent burrows,

and soil compaction. Crushing of rodent burrows could result in reduced escape cover, as well as direct morality to snakes and/or frogs, if they are present in the burrows. Collection and both intentional and non-intentional harassment are also management concerns in areas where humans encounter snakes, such as at recreation areas.

Gravel mining in the OWA may also impact giant garter snakes and California red-legged frogs. Equipment, noise, ground shaking, and human activity associated with the mining may degrade habitat in the immediate area and may displace snakes, if they occur in the area.

Lower Feather River

Current Project O&M does not affect garter snake or red-legged frog habitat in the Lower Feather River below the OWA.

7.2.1.2 Potential Activities Associated with Resource Actions

Resource Actions that have the greatest probability of affecting the giant garter snake and/or California red-legged frog include (1) fish passage enhancements; (2) the OWA Management Program; (3) the Thermalito Afterbay Wildlife Development; (4) lower river fish habitat improvements; (5) invasive plant species control; (6) mechanical changes to the river channel; and (7) water level changes in the Thermalito Afterbay. Implementation of these Resource Actions may require various activities that can affect both species (see Section 5.4 for description of activities).

Implementation of Resource Actions that involve construction with heavy equipment (e.g., access improvements, fish barrier construction, irrigation system development, road and trail construction and maintenance, sign installation, and vegetation type conversion) may result in disturbance effects to giant garter snakes and/or red-legged frogs or modifications to their habitat. In-water construction associated with fish-related Resource Actions and the land-based access needed for in-water activities may result in onetime or periodic impacts to giant garter snake/California red-legged frog habitat and disruption and displacement of snakes, if present. These activities may also create minor impacts caused by soil disturbance, vegetation removal, and human activity.

The most likely impacts to giant garter snakes and California red-legged frogs from activities required to implement Resource Actions would include disruption and displacement of individuals, and habitat loss and degradation. Direct mortality of some individuals is also possible. The following sections describe the effects of activities associated with Resource Actions specific to the various segments of the Project.

Thermalito Complex and OWA

Implementation of a number of Resource Actions at the Thermalito Complex and OWA would involve land-based construction. This activity could adversely affect the quality and quantity of habitat by removing vegetation, increased potential for road-kills, crushing rodent burrows used for cover and/or by compacting the soil and reducing the

potential for the creation of new burrows. In addition, weeds that colonize areas of soil disturbed by construction may degrade habitat quality, reducing the overall carrying capacity of the area for giant garter snakes or California red-legged frogs. Construction could also disrupt and displace individuals of these species and/or interrupt breeding behavior.

Several Resource Actions that could be implemented in the Thermalito Complex would involve use of herbicides and mechanical measures to control weeds and installation of signs and fences to protect sensitive resources. These activities may periodically disturb California red-legged frogs and/or giant garter snakes over the new license period, but the effects are likely to be short term. There are, however, more noxious weed infestations in the OWA than in the Thermalito Forebay or Thermalito Afterbay, so treatment, removal, and replanting will likely occur more frequently and perhaps for longer periods.

Potential water level changes in the Afterbay that would result from several proposed Resource Actions for fish, recreation, and downstream agriculture may increase the amount of mud flats, thereby isolating water from emergent and upland vegetation. These changes increase the distance between forage and escape cover and potentially increase the risk of predation. Elevated water levels also inundate exposed shoreline basking habitat and potentially flood rodent burrows used by both the garter snake and red-legged frog for escape cover. Frequent water level fluctuations would decrease available food supplies, particularly for giant garter snakes, and escape refugia for both species.

Lower Feather River

Potential fish habitat enhancements in the Lower Feather River below the OWA may require in-water and land-based construction. These activities may result in temporary disturbance to California red-legged frogs and/or giant garter snakes and the loss of a small amount of habitat potentially used by these species in riparian and aquatic habitats. Once in place, fish enhancement structures are not likely to adversely affect either species. Resource actions to improve riparian habitat conditions along the river may benefit some species but adversely affect giant garter snake habitat if the result is an increase in the density of riparian vegetation, which may produce unacceptably high levels of shade, or if the riparian diminishes open areas used for basking. Some Resource Actions related to in-river fish habitat improvement have the potential to increase velocities, decrease water temperature, or degrade backwater habitats. All of these results could adversely affect giant garter snakes.

7.2.2 Indirect Effects

Indirect effects on the giant garter snake and/or California red-legged frog from activities associated with Project O&M and Resource Actions are described in the following sections.

7.2.2.1 Current O&M Activities

Project O&M activities along or near the Feather River and in the Thermalito Complex that allow non-native noxious weeds to establish may indirectly alter habitat for giant garter snake and California red-legged. Long-term use of chemicals to retard or kill vegetation and control rodents or other pests that may affect human health conditions could indirectly affect food, water quality and habitat structure for these species.

7.2.2.2 Potential Activities Associated with Resource Actions

Indirect effects of Resource Action activities on giant garter snakes and California red-legged frogs may be the result of changes in water quality, gradual loss of important habitat elements such as structures or open areas for basking, changes in availability of food sources and/or supply, disruption and/or displacement of individuals and behavioral patterns. Over the long-term, installation of fencing to protect sensitive resources and signs to educate the public about snakes and unique habitats, such as vernal pools, should benefit giant garter snakes. Future increases in land-based recreation may cause additional loss of habitat, disturbance, and direct mortality from vehicular traffic, harassment, and collection/killing. Several Resource Actions (e.g., such as creation of new/improved juvenile salmonid rearing habitat) have the potential to be created in a manner that may also benefit giant garter snake.

7.2.3 Other Consultations and Effects on Critical Habitats

Critical habitat does not occur within the Action Area for either the giant garter snake or the California red-legged frog.

A PBO, File number 1-1-F-97-149, was issued by the Service November 13, 1997 addressing the giant garter snake. This PBO is entitled “Programmatic Formal Endangered Species Act Consultation of Issuance of 404 Permits for Projects with Relatively Small Effects on the Giant Garter Snake within Butte, Colusa, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter and Yolo Counties, California”.

7.2.4 Mitigation and Enhancement Measures

Fourteen separate minimization, conservation, and enhancement measures for the giant garter snake developed by DWR in consultation with USF&WS are described in Section 5.5.2. These measures are associated with existing Project O&M, as well as activities associated with the Resource Actions. Implementation of these measures would be expected to reduce or eliminate the effects of any activities potentially disturbing giant garter snakes or their habitats. The giant garter snake measures, along with those developed for vernal pools, will also provide protection for the red-legged frog.

Avoidance Measures

Impacts to giant garter snakes and California red-legged frogs and their habitats from activities associated with exiting Project O&M and activities associated with Resource Actions will be avoided to the extent possible through the following measures.

- Restricting construction activities and most rodent control near the Thermalito Forebay and Thermalito Afterbay, excluding the dams to areas beyond 200 feet from wetlands.
- Restricting burning of wetlands margins and /or disking of unvegetated portions of the Thermalito Afterbay drawdown zone
- Restricting the use of dog-training field exercises in Thermalito Afterbay area, waterfowl brood pond wetlands and adjacent upland areas.
- Limiting disking, planting, and cultivation for forage/cover crops, to periods when giant garter snake are active to avoid burying snakes in burrows.
- Limiting planting of forage/cover crops within 200 feet of the uplands edges of any giant garter snake wetlands habitat.
- Restricting activities in Area “D” of the OWA that may change hydrology of the area and significantly alter quality and extent of wetlands habitat.
- Conducting protocol-level survey in areas of potential California red-legged frog habitat potentially affected by Project O&M or activities associated with Resource Actions, and avoiding or minimizing adverse affects.

7.2.4.1 Conservation Measures

Specific measures to be implemented by DWR that will help conserve habitat for the giant garter snake include the following:

- Maintaining structural components of giant garter snake habitat (i.e., LWD) that accrue or move through natural processes.
- Developing and implementing a continuing public education program with a goal of preventing giant garter snakes from being intentionally harmed or killed.
- Removing non-native or noxious weeds, trees or shrubs that colonize any giant garter snake wetlands habitat only by hand, using hand tools, or through individual treatment with appropriate herbicides.

7.2.4.2 Mitigation Measures

Potential impacts to giant garter snake and red-legged frog habitat will be mitigated through the construction of four new brood ponds, totaling about 21 acres in the

Thermalito Afterbay area. In addition, DWR will maintain the existing amount and quality of giant garter snake/California red-legged frog habitat. Small habitat losses resulting from anticipated construction and maintenance and activities associated with Resource Actions will be replaced at a 1:1 or 2:1 ratio, depending upon whether the habitat replacement occurs prior to impact or during and after impact, respectively. DWR will ensure, to the extent possible, that activities related to other potential Resource Actions within the OWA, such as improvement in salmonid habitat, will be designed and built in a manner so as to also benefit giant garter snake/California red-legged frog habitat. Further, DWR will ensure that measures associated with retention of the flood detention basin and by beavers in the area do not adversely affect giant garter snake/California red-legged frog habitat and habitat connectivity. To facilitate their cooperation in the conservation of these species DWR will also provide gravel-mining lessees, operating within the FERC Project Boundary and within 200 feet of giant garter snake habitat, copies of the USFWS PBO or BO issued as part of the FERC relicensing action as well as DWR's habitat mapping and this programmatic biological assessment. Similarly, DWR will provide to Caltrans, Butte County Department of Roads and Highways, irrigation districts and private landowners who maintain culverts, ditches, canals and other wetland-related structures along and under State highway 99 along the westerly edge of the Thermalito Afterbay, copies of the USFWS PBO or BO issued as part of the FERC relicensing action as well as DWR's habitat mapping and this programmatic biological assessment.

To the extent that vernal pools exist in the Action Area and serve as potential giant garter snake/California red-legged frog habitat, a number of conservation measures have been developed and are discussed in the Chapter 5.0 Description of Proposed Action to ensure vernal pool protection.

7.2.4.3 Enhancement Measures

Activities associated with a number of Resource Actions for the Oroville relicensing will, in the long term, enhance giant garter snake/California red-legged frog habitat. For example, development of four new brood ponds near the Thermalito Afterbay and successful implementation of measures to remove noxious weedy species and replace them with native vegetation will result in improved and enhanced habitat composition and structure. Specific conservation measures designed to enhance habitat for the giant garter snake include:

- Maintaining semi-permanent wetlands in the brood ponds areas by operating the Afterbay to achieve a water surface elevation of at least 133.5 feet for at least 12 consecutive hours at least once per month annually during the giant garter snake active period April through September;

- Removing as many large (> 6 inches) predatory fish as practical from each waterfowl brood pond at least once every 2 years.

7.3 DELTA SMELT

7.3.1 Direct Effects

Delta smelt do not occur within the FERC Project Boundary or in the Sacramento River upstream of the confluence of the Sacramento and American rivers.

The Oroville Facilities along with other State Water Project Facilities and the Central Valley Projects are required to operate in compliance with objectives in the 1995 Water Quality Control Plan (SWRCB 2000) and requirements of various Biological Opinions issued by the Service and National Marine Fisheries Service to protect special-status species and designated critical habitats including Delta smelt. Two objectives of the Water Quality Control Plan related to the Delta smelt are: 1) salinity objectives for managed portions of Suisun Marsh to protect vegetation, from excessive salinity in channels and soil water and 2) Sacramento and San Joaquin River flow objectives to provide attraction and transport flows and suitable habitat for various life stages of aquatic organisms including Delta smelt and Chinook salmon.

The recently published Operations Criteria and Plan Biological Assessment (USBR 2004) concluded that inflows to the Delta from upstream projects are not expected to adversely affect the delta smelt.

7.3.2 Indirect Effects

While upstream Project releases may affect the population distribution of Delta smelt a substantial distance downstream from the FERC Project Boundary by influencing water level conditions such as through flushing or lowering water levels and stranding habitat, due to the complexity of contributions from other projects within the Sacramento River watershed and Bay-Delta the significance of such indirect effects of project operations on the Delta smelt are impossible to predict (USBR 2004). Oroville Dam and project related changes in downstream hydrology serve to limit recruitment of LWD below the reservoir. Thus, large woody debris which would have been contributed to the Feather and Sacramento river systems and slowly over time worked its way downstream all the way to the Delta, is reduced. The Service asserts that this could result in diminished substrate that may be important to delta smelt spawning, as egg attachment substrate.

7.3.3 Critical Habitat

Critical habitat of the Delta Smelt is restricted to the Delta and inland waters as defined in 59 FR 65256 and does not extend to the confluence of the Sacramento and Feather rivers.

7.4 VERNAL POOL INVERTEBRATES

The three listed vernal pool branchiopods—vernal pool fairy shrimp, Conservancy fairy shrimp, and vernal pool tadpole shrimp—are addressed together in the following discussion, since they share the same habitat and would be affected similarly by

activities associated with Project O&M and Resource Actions. All of the mapped vernal pools in the Action Area are located in the general vicinity of the Thermalito Afterbay and Thermalito Forebay. Impacts from activities associated with current O&M and Resource Actions at Lake Oroville, and along the Feather River (Thermalito outlet and low flow channel) are not discussed for vernal pool invertebrates because potentially suitable habitat is not present.

7.4.1 Direct Effects

Direct effects of current Project O&M activities and activities associated with Resource Actions are described below for vernal pool invertebrates.

7.4.1.1 Current O&M Activities

The greatest regional threat to the listed vernal pool invertebrates is habitat loss from development, and hydrology and water quality impacts from adjacent land uses (Witham et al. 1998). The current Project O& M activities can potentially affect these habitats through (1) disturbance of soil and vegetation during construction of new facilities, maintenance, and recreation sites; (2) siltation or sedimentation from road run-off and ORV traffic; and (3) environmental contaminants from herbicides and pesticides.

Current Project O&M activities may affect potential vernal pool invertebrate species habitat through routine periodic use of chemicals such as herbicides and/or pesticides. For example, pesticides and herbicides are used to control undesirable rodents, insects, and vegetation on the Thermalito Forebay Dam and Thermalito Afterbay Dam. These chemicals may be toxic to vernal pool invertebrates, resulting in direct mortality or reduced reproductive success; food sources may also be affected and decline.

Sedimentation or siltation may result from inadequate drainage of unsurfaced roadways and road enhancements, such as grading. Sedimentation may affect pools by increasing water turbidity or by filling so that water no longer ponds. Sedimentation can also cause direct mortality by suffocating invertebrates.

Maintenance practices that involve earth moving may directly affect the hydrology of vernal pools, degrading or destroying this habitat in some locations. Altered hydrology may result from filling the pool entirely with soil or increasing drainage so that the pool does not hold water. Altered hydrology may result in direct mortality to vernal pool invertebrates, reduced carrying capacity, or decreased breeding success. All of these outcomes would be expected to reduce vernal pool invertebrate populations within the Action Area.

Current upland habitat enhancement projects that include soil disking (for waterfowl and upland game bird enhancements) may directly affect the hydrology of vernal pools by disrupting the impermeable hardpan soil layer. These activities would potentially result in increased drainage, effectively destroying the pool. Soil disking may also affect surface flows by leveling the terrain surrounding pools so that overland flows are not

adequate to fill pools. Vernal pool invertebrates would be directly impacted, as they would likely be unable to hatch or reproduce.

Recreation in the area of vernal pools (e.g., ORV use) may have an adverse effect on the pools and their species by increasing sedimentation and introducing non-native plant species. ORV use or other forms of recreation, (e.g., biking) may also compact soils. Soil compaction may directly alter overland flow patterns, degrade habitat suitability for some vernal pool plant species, or encourage algae growth, thus directly affecting the pools' suitability to sustain a viable invertebrate population. ORV use may also result in physically crushing or directly damaging adults and cysts within a vernal pool.

7.4.1.2 Potential Activities Associated with Resource Actions

Activities related to potential Resource Actions that may directly affect vernal pool species include earthmoving activities, such as soil disking for project enhancements for wildlife or recreation, or facility maintenance and improvements. These impacts would be similar to those described above and may occur only one time or seasonally, depending upon the actions required. However, any activities in or near vernal pools that would directly fill, alter the hydrology, disturb the impermeable hardpan, compact soil, or alter the soil or water chemistry would impact vernal pool invertebrate species.

Use of chemicals, including herbicides, pesticides and fertilizers, to accomplish some Resource Actions or programs such as noxious weed treatment and waterfowl forage improvements, could, if not carefully applied, cause effects similar to those described above under Project O&M chemical use. Any change in water chemistry would be considered deleterious to vernal pool invertebrates.

Activities associated with Resource Actions that involve installing signs and fencing to protect sensitive resources would be a beneficial impact, since protecting vernal pools from recreational uses or other disturbing activities would benefit vernal pool invertebrates.

7.4.2 Indirect Effects

Indirect effects on the vernal pool invertebrates from activities associated with Project O&M and Resource Actions are described below.

7.4.2.1 Current O&M Activities

Maintenance activities may inadvertently cause siltation of vernal pools at some point in the future due to sudden heavy rain events. Additionally, unintentional drift of chemicals used in accordance with the conservation measures may affect vernal pools and would be considered indirect effects.

7.4.2.2 Potential Activities Associated With Resource Actions

Indirect impacts to vernal pools from activities associated with Resource Actions may occur as a result of installing road closure barriers or other earth moving activities that inadvertently cause future erosion or siltation.

Increased future recreation (e.g., ORVs) associated with proposed Resource Actions in the vicinity of vernal pools may have adverse indirect effects on vernal pools, which would be similar to those described above for direct effects.

7.4.3 Other Consultations and Effects on Critical Habitats

Critical habitat for the vernal pool invertebrates currently does not occur within the Action Area. However, critical habitat may be designated in the future. DWR has developed and is implementing a land management plan "Land Management Plan for the Protection of the Potential Habitats for Special Status Species of Fairy and Tadpole Shrimp" (DWR 2004) to protect vernal pool habitats.

7.4.4 Mitigation and Enhancement Measure

DWR proposes 11 separate measures to protect, enhance, or mitigate impacts for vernal pool species (see Section 5.5.4).

7.4.4.1 Avoidance Measures

Future direct and indirect impacts to vernal pool habitat will be avoided to the maximum extent possible and feasible throughout the life of the FERC license through the implementation of the vernal pool management plan. This plan includes measures for the proper design of roads, trails, and roadway drainage; maintenance requirements; and provisions for strict construction monitoring for work near vernal pools. Thus, impacts on vernal pools from these impacts would be avoided. All inventoried vernal pools will be surveyed annually for five years, after which survey would be conducted every other year and existing protective fencing will be maintained. Signage and patrols will be used to minimize ORV impacts. Improved road management including revegetating unneeded roads, applying gravel to minimize sedimentation, and improved sediment trapping in selected locations will all aid in avoiding impacts to vernal pool habitat.

Disking and other ground-disturbing habitat enhancements will be prohibited, to the extent possible, from within 200 feet of vernal pools, while application of herbicides will not occur within 200 feet

7.4.4.2 Conservation Measures

As described in Section 5.5.4, DWR is committed to maintaining the same number and quality of the vernal pool habitat that currently exists within the Action Area. Future direct impacts to all currently existing vernal pools will be avoided to the maximum extent possible.

7.4.4.3 Mitigation Measures

The Proposed Action includes mitigation measures for impacts to vernal pools. Small project O&M impacts that exceed an average of 0.50 acre annually, or 4.0 acres over the life of the FERC license, would be compensated for as follows: (1) creation at 1:1 replacement if creation precedes the impact by more than 6 months; (2) creation at 2:1 replacement if creation occurs less than 6 months before the impact; and (3) 2:1 preservation (i.e., permanently preserving through purchase, banking, conservation easement, or other means preserving a threatened vernal pool habitat).

7.4.4.4 Enhancement Measures

The Proposed Action includes enhancements such as road closures, which are intended to decrease current and future impacts to vernal pools by eliminating vehicle use, and reducing unsanctioned recreation use, sedimentation/siltation, and water quality concerns.

7.5 VALLEY ELDERBERRY LONGHORN BEETLE

Elderberry shrub habitat occurs throughout most of the Action Area, although it is generally absent from the Thermalito Complex and highly uncommon at Lake Oroville. Activities related to Project O&M and the Resource Actions may have the potential to affect the valley elderberry longhorn beetle and its habitat.

7.5.1 Direct Effects

Direct effects of current Project O&M activities and activities associated with Resource Actions are described below for the valley elderberry longhorn beetle.

7.5.1.1 Current O&M Practices

Current O&M activities can potentially affect valley elderberry longhorn beetle habitat through (1) maintenance and recreation activities that disturb soil and vegetation and damage or remove elderberry plants; (2) road run-off and ORV traffic that damage elderberry shrubs; (3) activities that isolate valley elderberry longhorn beetle populations by fragmenting habitat; and (4) use of herbicides and pesticides that result in environmental contaminants and/or kills the beetles or their host plant. The following sections describe the effects specific to each Project geographic location, Lake Oroville, Thermalito Diversion Pool transmission line rights-of-way, Thermalito Complex (Thermalito Forebay and Thermalito Afterbay), OWA and lower Feather River.

Lake Oroville

Elderberry shrubs are uncommon within the Lake Oroville area occurring at only four locations over 100 feet from Lake Oroville. It is unlikely that this habitat will be directly affected by O&M activities due to their isolation from project features.

Elderberry shrubs are more common within the Feather River corridor between Oroville Dam and the Fish Diversion Pool and along the Power Canal. Within this area, 45 elderberry stems greater than 1-inch in diameter occur within 100 feet of project features, including roads, trails, and day use recreation areas, the Power Canal, the Diversion Dam, and the Fish Barrier Dam. ORVs, pesticide use, grading for roads and fuel breaks, materials storage and additional recreation development could adversely affect elderberry habitat in this area. All of the elderberry bushes are located in areas where ORV use is either controlled, such as at the Power Canal, or in steep or rocky areas where ORV use does not occur (i.e., downstream from the Diversion Dam). Pesticide use in the general vicinity of these elderberry shrubs is currently restricted within 100 feet of mapped elderberry stems to avoid effects of pesticide drift on the habitat and inadvertent spraying of the bushes. In order to avoid soil compaction and inadvertent breaking of stems, DWR maintains a 25-foot buffer around elderberry shrubs during ground-disturbing maintenance activities.

Transmission Line Rights-of-Way

Maintenance of 11.3 miles of transmission line right-of-way includes only mechanical vegetation control, tree trimming and topping. A small number of elderberry shrubs are present within the transmission line right-of-way. These shrubs do not reach a height that requires topping and current DWR maintenance procedures prohibit pruning and trimming of elderberry bushes. However, elderberry shrubs and habitat could be adversely affected by removal of nearby overstory vegetation or mechanical damage associated with overstory removal.

Thermalito Complex and OWA

Elderberry shrubs are absent from the Thermalito Forebay and Afterbay and effects from current O&M activities in these areas are not anticipated. However, elderberry shrubs are common in the OWA, occurring in high densities on nearly all-existing levees bordering the Feather River. Elderberry shrubs are virtually absent from areas off the levees where groundwater levels are higher. During relicensing surveys, valley elderberry beetle emergence holes were commonly found in larger shrubs (>5 inches in diameter) and elderberry bushes supporting larger stems comprised a significant percentage of the total shrubs in the area. The existing levee system occurs throughout the OWA and provides good connectivity between subpopulations and dispersal corridors for adult valley elderberry longhorn beetles. Potential adverse impacts to the valley elderberry longhorn beetle in the OWA could occur from (1) levee road maintenance activities, (2) emergency levee repairs related to flood damage, (3) ORV use, and (4) eradication and control of non-native plant species.

DWR maintenance activities in the OWA focus on maintenance of gravel levee roads. Annual maintenance is required to provide safe public access. Specific safety issues include localized potholes deep enough to affect vehicle control and safety, blind corners, and diminished road width from vegetative growth including large elderberry

shrubs. Removal of elderberry shrubs and stems contributing to this public safety issue would be a significant adverse impact to the valley elderberry beetle and its habitat.

Extensive levee repairs related to flood flows have been required in the past in the OWA and the need for such repairs is expected in the future. These repairs included rebuilding or reinforcing gravel levees. The presence of valley elderberry shrubs limits the engineering options for levee repairs and increases cost.

ORV use within the OWA, particularly on the levees, is uncommon and sporadic. The steep levee slopes and loose slope material generally serve to limit ORV use near levees. Habitat damage, such as crushing and uprooting elderberry shrubs, and killing individual valley elderberry longhorn beetles, may occur near a recreation use area near the Thermalito Outfall to the Feather River. Gravel harvesting of dredger spoil piles occurs in the OWA under leases administered by DWR. Gravel harvesting could directly impact elderberry shrubs if present, by causing direct loss of shrubs or breakage of branches, disruption of microclimate conditions and erosion of soils.

Feather River Below the FERC Project Boundary

Future operational changes in flow regimes could affect the quantity and quality of valley elderberry longhorn beetle habitat downstream along the Feather River corridor. The extent of these effects cannot be determined at this time but the magnitude of the flow changes are not anticipated to affect elderberry shrubs, which typically do not occur at the lower elevations along the river floodplain.

7.5.1.2 Potential Activities Associated with Resource Actions

Resource Actions that could be implemented that have the greatest probability of affecting valley elderberry longhorn beetle include: the OWA Management Program, the Thermalito Afterbay Wildlife Development, lower river fish habitat improvement, invasive plant species control, recreational facility enhancements, and mechanical changes to river channels. Each of these Resource Actions may have various types of activities that can affect these species (see Section 5.4 for description of activities).

Lake Oroville

As described earlier, elderberry shrubs are uncommon within the Lake Oroville area, occurring at only four isolated locations. It is unlikely that this habitat will be directly affected by activities from implementation of Resource Actions due to their location.

Activities associated with Resource Actions related to roads, trails, and day-use recreation areas at the Power Canal, the Diversion Dam, and the Fish Barrier Dam could potentially adversely affect valley elderberry beetle habitat and valley elderberry beetles. These activities include ORV use, pesticide use, grading for roads and fuel breaks, materials storage and additional recreation development. Land based construction to add new and/or improve facilities, existing camping or boating access, and existing access roads could affect elderberry shrubs by removing or breaking stems

or entire plants or crushing. Soil disturbance such as compaction or siltation, can damage roots desiccate plants. Alteration of elderberry habitat through vegetation removal, including herbicide use for noxious weed removal programs, may directly affect elderberry shrubs and stems or the beetle itself when it emerges as an adult. Additional access to recreational areas or boating along the lake may increase the probability of damage to elderberry shrubs along Lake Oroville due to human disturbance.

Thermalito Complex and OWA

Activities associated with Resource Actions in the OWA that may directly affect the valley elderberry beetle and its habitat include land based construction, habitat enhancements (e.g., salmonid habitat or riparian enhancement), use of herbicides and pesticides for noxious weed control, enhancement of recreation and new recreational development including boat ramps, campgrounds, roads and parking areas and increased human activity in the OWA. The effects of land-based construction would be as described above.

Several activities implemented in association with Resource Actions in the OWA may assist in the preservation of elderberry shrubs, such as installation of signs explaining the sensitivity of the shrub and its importance to the valley elderberry longhorn beetle. These signs not only may protect a specific habitat area but also may raise public awareness of their status.

7.5.2 Indirect Effects

Indirect effects on the valley elderberry longhorn beetle from activities associated with Project O&M and Resource Actions are described below.

7.5.2.1 Current O&M Activities

Indirect impacts to the valley elderberry longhorn beetle may occur through herbicide or pesticide applications (that occur outside the 100-foot buffer) that drift into the buffer area and affect elderberry shrubs by either killing the shrubs or reducing vigor and health. Removal of riparian canopy around an elderberry shrub could also affect the shrub habitat causing it to be a less suitable habitat for the beetle.

7.5.2.2 Potential Activities Associated with Resource Action

Future operational changes in flow regimes associated with Resource Actions could affect, over the long-term, the quantity and quality of valley elderberry longhorn beetle habitat downstream along the Feather River corridor. Depending upon timing and quality of flow releases, opportunities may exist to increase recruitment or retention of riparian habitat downstream from the FERC Project Boundary and increase elderberry shrub habitat in the riparian/upland ecotone along the Feather River.

7.5.3 Other Consultations and Effects on Critical Habitats

There is currently no critical habitat designated for the valley elderberry longhorn beetle within the Action Area. A programmatic formal consultation, File Number 1-1-96-F-66, was completed September 19, 1996 for the valley elderberry longhorn beetle entitled "Programmatic Formal Consultation Permitting Projects with Relatively Small Effects on the Valley Elderberry Longhorn Beetle Within the Jurisdiction of the Sacramento Field Office, California".

7.5.4 Mitigation and Enhancement Measures

As described in Section 5.5.5, DWR is committed to maintaining the same number, quality, and ecological connectivity of the valley elderberry longhorn beetle and elderberry plants that currently exist within the FERC Project Boundary. DWR proposes two measures that directly address valley elderberry longhorn beetle. These include (1) maintaining at least 95 acres of elderberry shrub (existing area occupied by elderberry shrubs plus a 25 foot buffer) within the FERC Project Boundary and mitigating for small unavoidable losses of habitat, and (3) implementing BMPs related to herbicide use during non-native plant abatement activities.

7.5.4.1 Avoidance Measures

Avoidance of all elderberry shrubs may not be possible due to the number of shrubs in the area and the activities required to maintain public safety. However, to avoid impacts to the valley elderberry beetle and its habitat, DWR currently requires dust abatement during road maintenance activities (which are mostly grading) and does not use pesticides or herbicides in these areas.

To avoid impacts to elderberry shrubs, CDFG is proposing an alternative management of the recreation use area near the Thermalito Outfall to the Feather River to contain recreational use including vehicular use.

DWR requires BMPs be implemented within their gravel harvest areas including measures to avoid disruption of elderberry bushes.

7.5.4.2 Conservation Measures

Conservation measures for the valley elderberry longhorn beetle are described in Section 5.5.5.

7.5.4.3 Mitigation Measures

In the event that Project O&M activities or activities associated with Resource Actions affect small amounts of elderberry shrubs in the future, mitigation measures set forth in the Description of Proposed Action (Section 5.5.5) would ensure that loss of the habitat will be replaced. DWR proposes to compensate for loss of up to 0.5 acres of elderberry shrub canopy annually, not to exceed a total of 5.0 acres of elderberry shrub canopy area over the life of the new FERC license. Compensation measures would follow the

USFWS's "Conservation Guidelines for the Valley Elderberry Longhorn Beetle" (July 9, 1999) and/or develop one or more conservation banks to offset both small impacts and larger impacts that may arise from future projects.

7.5.4.4 Enhancement Measures

There are several possible enhancement measures that, if implemented, could improve valley elderberry longhorn beetle habitat within the Action Area. These potential enhancements include planting of elderberry shrubs to increase connectivity, increase riparian habitat and potential for natural recruitment of valley elderberry shrubs within riparian/upland ecotone and potential establishment of conservation banks to increase valley elderberry habitat.

7.6 CANDIDATE AND PROPOSED WILDLIFE SPECIES

The western yellow-billed cuckoo is the only candidate species for listing that potentially occurs in the vicinity of the Action Area. Potential suitable habitat for this species exists within the OWA and down river to the confluence of the Sacramento River. Other riparian forest habitats within the Action Area are not sufficiently large nor do they possess the required vegetation structure necessary for the western yellow-billed cuckoo. Therefore effects described below focus on the Oroville Wildlife Area within the Action Area

Habitat for the mountain yellow-legged frog does not exist within the Action Area. Hence, project activities will not affect the species or its habitat.

The California tiger salamander has not been historically documented within the Action Area and adjacent areas. Project effects are not anticipated on this species. Potential suitable habitat would be managed and protected as discussed in the "Land Management Plan for the Protection of the Potential Habitat of Special Status Species of Fairy and Tadpole Shrimp" (DWR 2004), described in Section 7.4.4 for Vernal Pool Invertebrates.

7.6.1 Direct Effects

7.6.1.1 Current O&M Activities

Any Project O&M activity that affects the distribution or quality of riparian habitat has the potential to affect the yellow-billed cuckoo. The current Project O&M activities may affect this species through (1) degradation of riparian habitat due to water level fluctuations and flood water detention; (2) trampling and removal of vegetation incidental to facility maintenance and recreation; (3) reduction in food resources due to alteration of habitat or application of herbicides and pesticides; and (4) risk of toxicity from environmental contaminants.

Current project operations may limit riparian expansion and enhancement by limiting cottonwood recruitment. Presently, cottonwood stands are even-aged and without

recruitment and are likely to decline in health as the stands age. Levees also reduce the aerial extent of riparian habitat by reducing the available floodplain.

The ongoing use of herbicides and pesticides near facilities and roads has the potential to alter riparian vegetation structure and reduce the insect prey base.

7.6.1.2 Potential Activities Associated with Resource Actions

Resource Actions that could potentially affect riparian habitat include fish habitat improvement, river channel modification, and alterations in instream flows. Activities associated with Resource Actions in the riparian floodplain could cause temporary losses of riparian habitat but over the long-term, the actions are more likely to create additional woody riparian vegetation. At this time, it is impossible to determine whether any Resource Actions that would alter flows would cause enough of a change that would allow for expansion and enhancement of riparian habitat.

7.6.2 Indirect Effects

In the long-term, increased recreational pressure or development could further fragment riparian habitat and result in additional human disturbance to cuckoos.

7.6.3 Mitigation and Enhancement Measures

There are no mitigation and enhancement measures directed specifically at the yellow-billed cuckoo. However, those measures that serve to protect or enhance riparian habitat may also benefit yellow-billed cuckoo.

7.7 THREATENED AND ENDANGERED PLANT SPECIES

No threatened and endangered plant species were found within the Action Area during field surveys although potential habitat for several species does exist and surveys cannot definitely confirm absence. It is possible that populations of one or more of the listed species could be found sometime in the future. Vernal pool habitats located in close proximity to the Thermalito Complex have the potential to support Butte County meadowfoam, Hoover's spurge, Green's tuctoria, hairy Orcutt grass and smooth Orcutt grass. Habitat for Hartweg's golden sunburst is present in the upland, hummocky areas within the annual grassland vegetation type. These "hummocky" habitats are basically slightly higher relief areas bordering vernal pools and swales and were considered to have very low potential to support Hartweg's golden sunburst. The serpentine and gabbro substrates in the Action Area around Lake Oroville have the potential to support Layne's ragwort. There will be no direct effects to any of the listed species, however, the direct and indirect effects to potential habitat are discussed in the following sections with respect to project operations and maintenance and proposed Resource Actions.

7.7.1 Direct and Indirect Effects on Potential Habitat for Listed Plants

Because there is currently no evidence that listed plant species occur in the Action Area, the discussion of potential direct and indirect effects is combined in the following sections for current O&M practices and activities associated with Resource Actions.

7.7.1.1 Current O&M Practices

Plants Associated with Vernal Pool Habitats

Vernal pools and swales that potentially support listed plant species are potentially affected directly and indirectly by O&M activities involving use of chemicals (herbicides, pesticides and fertilizers), changes in hydrology, and sedimentation during or after earthmoving. ORV use, other forms of recreation, and upland habitat enhancement projects could also directly affect vernal pool habitats. The activities associated with Resource Actions near the Thermalito Complex could potentially invoke any of these direct impacts to vernal pool habitats (see Section 7.4.1 for greater discussion of direct effects on vernal pools).

The direct and indirect effects to vernal pools generally involve activities and practices that inadvertently kill vernal pool plant species, or affect pool water quality and hydrologic patterns. Activities that disturb soil and lead to erosion, especially during rain events, can lead to sedimentation in pools and swales. In addition to actually burying and killing vernal pool plants, sedimentation can lead to altered inundation duration and altered pool morphology thereby affecting vernal pool plant species that are typically beholden to very specific hydrological and soil conditions. These practices potentially alter the vernal species composition and can even displace native vernal pool plant species with weedy plant species better adapted to disturbed habitats.

Herbicide drift into vernal pool habitats has the potential of killing vernal pool plant species and contaminating the soil so that resident mychorrizae and vernal pool plant species are impaired or killed.

Plant Species Associated with Serpentine- and Gabbro-derived Soils

Serpentine- and Gabbro-derived soils are potential habitat for Layne's ragwort and are located within the Action Area in two general locations. Serpentine-derived soils are located on the north side of Lake Oroville near the North Fork Arm and the West Branch Arm. Gabbro-derived soils are located near Stringtown Mountain on the south side of Lake Oroville.

Many of the areas that are potential habitat for Layne's ragwort within the Action Area around Lake Oroville have steep slopes with little access except from foot traffic and boats. Where this potential habitat occurs near the normal high water level, reservoir pool level fluctuations could erode this habitat. In a few areas, access roads and recreation facilities are present within potential habitat including access roads to the Nelson Bar car top boat launch and Lime Saddle recreation sites on the West Branch

Arm and Springtown car-top boat launch on the south side of the lake. A dirt road accessible to the public also cuts through various patches of potential habitat along the north side of the North Fork Arm. In these areas, potential Layne's ragwort habitat could be directly affected by ORV traffic, other recreation, and Project O&M. Periodic maintenance activities associated with recreation sites and access roads include vegetation removal and herbicide application.

7.7.2 Potential Activities Associated with Resource Actions

Implementation of Resource Actions at Nelson Bar and Springtown car-top boat launches and at Lime Saddle recreation sites represent one-time activities involving earth moving, soil disturbance, signage and vegetation removal associated with the expansion and improvement of recreation facilities. Recreation use will be a continuous potential direct impact on Layne's ragwort habitat at these sites. These same activities also present potential indirect impacts primarily due to erosion/sedimentation and pesticide drift where they occur adjacent to potential habitat.

7.7.3 Mitigation and Enhancement Measures

There are no mitigation and enhancement measures directed specifically at listed plants. However, those measures that serve to protect or enhance vernal pools would also benefit those plant species that could occur in such habitats. If, in the future, populations of a federally listed plant species become established in the Action Area, DWR will develop measures to protect the individual plant populations and the habitat.

Adherence to conservation measures outlined in Chapter 5.0, Description of the Proposed Action, should minimize or eliminate the potential direct and indirect impacts to vernal pool habitats.

8.0 CUMULATIVE EFFECTS

Cumulative effects are those state, local and private actions that may affect species listed as threatened or endangered under the auspices of the federal ESA and critical habitat of such species, and that have a reasonable certainty of occurring in the Action Area in the foreseeable future. Cumulative effects include habitat loss and degradation affecting federally listed species addressed in this BA as a result of urban development, changes in agricultural practices and/or expansion of agriculture, flood control, river and stream bank protection, proliferation of non-native noxious weeds affecting habitat quality and quantity, competition from non-native wildlife, and other actions that may adversely affect the subject species and their habitats. Other FERC hydroelectric power projects upstream of the Action Area are not considered in this section since they are addressed in other separate ESA Section 7 consultations. Most of these types of actions are those that have resulted in decline of the species that are the subject of this BA. See Chapter 6.0, Species Accounts and Status in the Action Area, for other human related factors affecting these species and their habitats.

8.1 DETERMINATION OF EFFECTS

8.1.1 Bald Eagle

Cumulative actions that may affect the bald eagle in the Action Area include recreation and development of recreation facilities not sanctioned by the FERC Project license, logging and other forest harvest activities, establishment of new roads and trails. Any of these actions that require prior approval by other agencies including the USFS, BLM, or DPR will be reviewed for potential ESA effects on the Oroville bald eagles by that agency under its ESA Section 7 consultation process.

8.1.2 Giant Garter Snake

A potential activity that may alter the habitat of the giant garter snake within the Action Area and represents a potential cumulative impact to this species is insecticide use by county and municipal agencies. Both Butte County, through its Mosquito Control District, and the City of Oroville annually administer active mosquito abatement programs, which apply insecticide fog around the Feather River and the Thermalito Complex, including the OWA. This program has the potential to reduce insect populations in the Action Area, and as such, could indirectly affect elements of the giant garter snake habitat and food supply.

In addition, CDFG and DPR treat purple loosestrife in the Thermalito Afterbay margin and noxious weeds along the wetland edge of the Thermalito Forebay, respectively (DWR 2003). While these programs comply with safety application criteria and reporting requirements, unforeseen accidents may have potential effects to the giant garter snake habitat.

No other projects that may have cumulative effects on giant garter snake have been identified in the Action Area.

8.1.3 California Red-legged Frog

Potential habitat exists in the Action Area for California red-legged frog although the habitat is degraded. Actions that may further degrade the habitat include insecticide use within the Action Area by county and municipal agencies. Butte County, through its Mosquito Abatement District, and the City of Oroville both administer annual active mosquito abatement programs, which apply insecticide fog around the Feather River and around the Thermalito Complex. These applications have the potential to decrease insect populations in the Action Area and as such could affect the California red-legged frog's food supply and degrade potential habitat.

No other specific actions or projects that would result in a cumulative impact on this species and its habitat have been identified in the Action Area.

8.1.4 Delta Smelt

No specific actions or projects that would result in a cumulative impact on this species and its habitat have been identified in the Action Area.

8.1.5 Valley Elderberry Longhorn Beetle

The valley elderberry longhorn beetle is found in isolated populations throughout the Central Valley, although locally common. Future threats to this species include continued human population growth, and further development of agriculture, cities, industry, transportation and water resources in the foreseeable future (USFWS 1996). However, the proposed action will maintain existing quality and quality of valley elderberry longhorn beetle habitat in the Action Area. If conservation banks are established as part of the Proposed Action, there will be a beneficial affect to the beetle with increased habitat for the preservation of this species.

Future activities that would have a cumulative effect on the elderberry beetle populations in the Action Area include herbicide use, recreation, and gravel extraction activities with the Action Area.

Butte County, through its Mosquito Abatement Program, and the City of Oroville both administer annual active mosquito abatement programs, which apply insecticide fog around the Feather River and around the Thermalito Complex. These applications have to potential to increase impact on insects, including valley elderberry longhorn beetle in the Action Area.

Indiscriminate and unauthorized recreational activities including camping, ORV travel and establishment of new trails in areas populated with valley elderberry shrubs may adversely affect the valley elderberry longhorn beetle by direct impact to elderberry shrubs and indirectly through soil disturbance and/or compaction affecting the elderberry shrubs.

Commercial and local mining companies extract gravel from the dredger spoils piles within the Feather River floodplain. Ongoing operations potentially could affect valley

elderberry longhorn beetle habitat through dust and habitat disturbance or destruction from extraction activities and truck traffic.

No other specific actions or projects that would result in a cumulative impact on this species and its habitat have been identified in the Action Area.

8.1.6 Vernal Pool Invertebrates

Vernal pool wildlife species are endemic to vernal pools in the Central Valley and a wide range of activities potentially affect vernal pool habitats and vernal pool wildlife and plant species (USFWS 1994). Activities include urban development, water, flood control, highway and utility projects, chemical contaminants and agricultural practices (USFWS 1994). Butte County, through its Mosquito Abatement Program and the City of Oroville, annually administer an active mosquito abatement, which applies insecticide fog around the Feather River and around the Thermalito Complex, including the OWA. These applications have the potential to directly affect vernal pool invertebrates and indirectly affect them by changing the fragile balance between water, soil, plants, and other vernal pool species.

ORV use and other recreational use of vernal pool areas may affect vernal pools through soil compaction, which may directly alter overland flow patterns and increase sedimentation, limit water collection within the pools or destroy the integrity of the physical properties of the pool. Soil compaction may also result in decreasing habitat suitability for some vernal pool plant species or encourage algae inhabitation, thus directly affecting the pools' suitability to sustain a viable invertebrate population. ORV use may also result in physically crushing or directly damaging adults and cysts within a vernal pool.

Road improvements undertaken by an agency other than DWR may affect vernal pool integrity through its actions, which may include grading, mechanical and/or chemical weed control, alteration of drainage patterns, alteration of soil chemical and physical characteristics inherent to vernal pool integrity.

Currently (as of August and September 2003) Butte County lists (pers. comm. Baker; 2003; pers. comm. Ostrander 2003) four proposed and permitted projects within two miles of the Action Area (FERC Project Boundary portion) that may result in a loss of vernal pools and vernal pool species. However, it is not known if vernal pools are located on or near these four properties and the effects that they would potentially have on vernal pools within the FERC Project Boundary.

No other specific actions or projects that would result in a cumulative impact on the species and their respective habitats addressed in this BA have been identified in the Action Area.

8.1.7 Western Yellow-Billed Cuckoo

Potential cumulative effects to the yellow-billed cuckoo habitat may occur in association with insecticide use by county and municipal agencies. Butte County's Mosquito

Control District uses aerial application of pesticides for mosquito abatement within the OWA and outlying areas in addition to the City of Oroville. These actions are intended to diminish human health risks associated with mosquitoes but may have an impact on the yellow-billed cuckoo's food source. The two pesticides used in this program are methoprene and malathion, which are known to have direct effects on a variety of insect larvae. This program may make the OWA and the areas surrounding the OWA not suitable for successful nesting by yellow-billed cuckoos or other insect eating birds because of the significant reduction in the prey base.

9.0 ANALYSIS OF NO-ACTION ALTERNATIVE

Under the No-Action alternative, the Oroville Facilities would continue to be operated as they are now, under the terms and conditions in the existing FERC License, and no new Resource Actions aimed at minimizing impacts or conserving listed species would be implemented other than those arising from existing legal obligations. DWR would continue existing maintenance practices needed to maintain the Oroville Facilities.

Project maintenance activities include routine repairs and maintenance, seismic monitoring and testing, and inspections necessary for water supply, flood management, power generation and recreation and environmental commitments and programs.

Operations of the Oroville Facilities are planned and scheduled in concert with other SWP facilities through the Coordinated Operations Agreement. The overall operations plan for the Oroville Facilities is updated regularly (i.e., yearly, weekly, and daily) to reflect changes in hydrology and downstream conditions. Releases from Lake Oroville are planned to accommodate the water supply requirements of local water users, Delta water quality, Feather River instream flow, water supply to the State Water Contractors and minimum flood management storage. The plan is updated as needed to respond to changing conditions, particularly water quality conditions in the Delta.

The status, distribution, and habitat conditions for threatened and endangered species within the Action Area would be the same as for the existing conditions that were defined by relicensing field surveys. These species include bald eagle, giant garter snake, California red-legged frog, Delta smelt, valley elderberry beetle, and vernal pool invertebrates and plants. Habitat would continue to be available for the western yellow-billed cuckoo. Local populations are expected to persist although unexpected natural events such as natural disasters, i.e. fire, extreme floods or disease, could result in short-term habitat loss and reduced populations. These species would continue to be vulnerable to cumulative development, human activity and recreation, ORV use, introduced predatory species, herbicide use, and other threats.

9.1 BALD EAGLE

Habitat within the Oroville FERC Project Boundary is managed for bald eagles per three Bald Eagle Management Plans (DWR 200a, 2004b and 2004c) to protect this species. DWR would continue implementing these plans until the species is de-listed by the USFWS and CDFG.

9.2 GIANT GARTER SNAKE

Potential project operational impacts on giant garter snake habitat from fluctuating water levels in the Thermalito Afterbay would continue. DWR would be required to enter into Section 7 consultation with the USFWS in order to continue these or other activities that may result in take of the giant garter snake.

9.3 DELTA SMELT

The Oroville facilities would continue to be operated to address water quality standards for the Delta per the SWRCB 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB 2000) and in compliance with requirements of Biological Opinions issued by the USFWS and NOAA Fisheries to protect special-status species and designated critical habitat for the Delta smelt.

9.4 VERNAL POOL WILDLIFE AND PLANT SPECIES

Vernal pool habitat within the Oroville FERC Project Boundary is managed for vernal pool wildlife and plant habitat per the "Land Management Plan for the Protection of the Potential Habitat of Special Status Species of Fairy and Tadpole Shrimp" (DWR 2004d) to protect these species. DWR would continue to implement this plan under the no-action alternative.

9.5 VALLEY ELDERBERRY LONGHORN BEETLE

Maintenance activities within the FERC Project Boundary including along the levee roads in the OWA would continue. Due to the extensive presence of valley elderberry longhorn beetle habitat along the levees and roads and increasing public safety problems due to vegetation overgrowth in the OWA, DWR would, at some point, need to enter into Section 7 consultation with the USFWS in order to conduct road maintenance activities in the OWA and other maintenance activities within the FERC Project Boundary requiring take of the valley elderberry longhorn beetle habitat.

10.0 CONCLUSIONS AND DETERMINATIONS

Based on the programmatic analysis of effects of activities associated with the Proposed Action (see Chapter 7.0, Effects of the Proposed Action), the Proposed Action was evaluated as to whether it had the potential to adversely affect threatened or endangered species or adversely affect critical habitat of a listed species. ESA Section 7 definitions used in this chapter conform with those described in the 1998 USF&WS Section 7 Handbook (USFWS 1998). Determinations were made for each species based on the following definitions:

No effect. The proposed action will have no effect on listed species or critical habitat. The no effect determination assumes that the proposed action will not jeopardize the continued existence of the species or adversely modify its critical habitat.

May affect, is not likely to adversely affect. The proposed action will have effects on a listed species but the effects are expected to be discountable, insignificant or completely beneficial. Beneficial effects are positive effects without any adverse effects.

Insignificant effects relate to the size of the impact and should not reach the scale where take occurs. Discountable effects are those that are extremely unlikely to occur. Based on best judgment, a person would not (1) be able to meaningfully measure, detect, or evaluate insignificant effects or (2) expect discountable effects to occur. May affect, not likely to adversely affect determination assumes that the proposed action will not jeopardize the continued existence of the species or adversely modify its critical habitat.

May affect, likely to adversely affect. The proposed action will have adverse effects to listed species as a direct or indirect results of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant or beneficial. A may affect, likely to adversely, affect determinations requires formal Section 7 Consultation and a determination of whether the project will jeopardize the continued existence of the species.

10.1 CONCLUSIONS

Based on an analysis of the Proposed Action, programmatic activities (defined in Section 5.4) associated with the maintenance and operation of the Oroville Facilities and implementation of Resource Actions, are likely to cause relatively small adverse effects on bald eagle, giant garter snake, three species of vernal pool invertebrates, and valley elderberry longhorn beetle and their habitats within the Action Area (Table 10.1-1). Some relatively small, but nevertheless adverse indirect effects to delta smelt due to LWD debris reductions in the Delta are possible. The implementation of proposed avoidance, minimization and compensation measures as part of the Proposed Action would reduce the level of impact to relatively minor levels and ensure that effects are adequately mitigated, and that these small impacts are not likely to jeopardize the continued existence of any of the species. There would be no effect to California red-legged frog, and seven species of vascular plants.

No critical habitat has been designated for any of the listed species within the Action Area, therefore, none will be affected.

Table 10.1-1 Conclusions and determination for ESA listed species and designated critical habitat with and without implementation of conservation measures.

Species/Critical Habitat	Determination		Rationale
	Without Conservation Measures	With Conservation Measures	
Bald eagle	May affect, likely to adversely affect	May affect, not likely to adversely affect	Project recreation and water level fluctuations would potentially result in reduced productivity and disturbance. Conservation measures would substantially reduce the level of impact.
Giant garter snake	May affect, likely to adversely affect	May affect, not likely to adversely affect	Shoreline vegetation management activities, recreation, and water level fluctuations may affect this species. Conservation measures would minimize impacts and mitigate for unavoidable impacts.
California red-legged frog	No effect	No effect	In the region of the Project, the California red-legged frog occurs primarily on tributaries beyond the influence of the Project.
Delta smelt	No effect	No effect	The Delta smelt only occurs well downriver of the Project. Potential downstream flow related affects addressed in OCAP BA/BO
Valley elderberry longhorn beetle	May affect, may adversely affect	May affect, not likely to adversely affect	Levee vegetation management activities and recreation, and may affect the availability of suitable elderberry shrub habitat for this species. Conservation measures would minimize impacts and mitigate for unavoidable impacts.
Western yellow-billed cuckoo	Not likely to jeopardize the continued existence	Not likely to jeopardize the continued existence	Survey data indicate that species is absent from the project area.
California tiger salamander	Not likely to jeopardize the continued existence	Not likely to jeopardize the continued existence	USF&WS guidance during study plan development indicated that Action Area outside of species range. No downstream impacts to species or habitat identified.
Mountain yellow-legged frog	Not likely to jeopardize the continued existence	Not likely to jeopardize the continued existence	Action area well below species elevational range. No upstream impacts identified.

Species/Critical Habitat	Determination		Rationale
	Without Conservation Measures	With Conservation Measures	
Vernal pool fairy shrimp, Vernal pool tadpole shrimp, Conservancy fairy shrimp	May affect, may adversely affect	May affect, not likely to adversely affect	Presence of these species is assumed as no surveys were conducted. Adoption of the Vernal Pool Resource Management Plan will avoid affecting potential habitat.
Slender Orcutt grass Hoover's spurge Layne's ragwort Butte County meadowfoam Hairy Orcutt grass Green's tuctoria Hartweg's golden sunburst	No effect	No effect	These species were not found during rare plant surveys conducted by DWR.
Critical Habitat			
California red-legged frog	No effect	No effect	No critical habitat within Action Area
Delta smelt	No effect	No effect	No critical habitat within or in proximity to Action Area
Conservancy fairy shrimp	No effect	No effect	No critical habitat within Action Area or Butte County
Vernal pool fairy shrimp	No effect	No effect	No critical habitat within Action Area or Butte County
Vernal pool tadpole shrimp	No effect	No effect	No critical habitat within Action Area or Butte County
Conservancy fairy shrimp	No effect	No effect	No critical habitat within Action Area or Butte County
Valley elderberry longhorn beetle	No effect	No effect	No critical habitat within or in proximity to Action Area

10.2 DETERMINATIONS

The aggregate effects of programmatic activities associated with the Proposed Action on listed species over the life of the FERC license are expected to be relatively small. With mitigation and annual review for cumulative take and habitat losses, the Proposed Action effects will be substantially reduced and will not jeopardize the continued existence of the listed species nor affect critical habitat of any species protected under the ESA.

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APPENDIX E2
NOAA FISHERIES OCAP BIOLOGICAL OPINION— FEATHER RIVER RELEVANT CONTENT

On October 22, 2004, NOAA Fisheries released its Biological Opinion (BO) on the effects of the proposed long-term operations, criteria and plan (OCAP) for the Central Valley Project (CVP) in coordination with operations of the SWP on federally listed endangered and threatened anadromous salmonids. Excerpts from the OCAP BO relevant to the Oroville Facilities relicensing are provided below.

PAGE 26—D. Description of SWP Facilities, Upstream of the Delta

1. Feather River Division

The Oroville-Thermalito Complex of the SWP includes facilities that conserve water on the Feather River for power generation, flood control, recreation, and fish and wildlife protection. The Oroville-Thermalito Complex includes the following: Oroville Dam and Lake (3.5 MAF capacity), and Edward-Hyatt Powerplant; Thermalito Diversion Dam, Power Canal, Diversion Pool, Diversion Dam Powerplant, Forebay and Afterbay; and the Fish Barrier Dam (see Figure 2-11 in OCAP BA). A maximum of 17,000 cfs can be released' from Oroville Dam through the Edward-Hyatt Powerplant. Approximately four miles downstream from the Oroville Dam/Edward-Hyatt Powerplant is the Thermalito Diversion Dam. The Thermalito Diversion Dam creates the Thermalito Diversion Pool which acts as a water diversion point and includes diversions to the Thermalito Power Canal on the north side of the Oroville-Thermalito Complex (i.e., majority of the flow; up to 17,000 cfs) and to the historical Feather River channel (i.e., *low* flow channel [LFC]) on the south side. Flows typically are a constant 600 cfs through this eightmile LFC section except when flood control releases from Lake Oroville occur.' The Fish Barrier Dam at the upstream end of the LFC is an impassable barrier that diverts water for use by the DFG Feather River Fish Hatchery.

The Thermalito Power Canal hydraulically links the Thermalito Diversion Pool to the Thermalito Forebay (11,768 AF capacity; offstream regulating reservoir for the Thermalito Powerplant). Water from the Thermalito Forebay exits through the Thermalito Powerplant into the Thermalito Afterbay where it either is diverted for agricultural use or is released back into the Feather River approximately 8 miles downstream of its original diversion point. Thermalito Afterbay provides water for local diversions that can require up to 4,050 cfs during peak demands. In addition, excess water conserved in storage within the Thermalito Afterbay can be used for pumpback operations through both the Thermalito and Edward-Hyatt Powerplants when economically feasible. The Thermalito Diversion Pool serves' as a forebay when the Edward Hyatt Powerplant is pumping water back into Lake Oroville.

An August 1983 agreement between DWR and DFG, *Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish and Wildlife,* sets criteria and objectives for flow and temperatures in the LFC and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement: (1)

establishes minimum flows between the Thermalito Afterbay Outlet and Verona which vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood control, levee failures, etc.; (3) requires flow stability during the peak of the fallrun Chinook salmon spawning season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the late spring and summer for shad and striped bass.

The Corps' flood control diagram specifies flood control requirements and regulating criteria for Lake Oroville. From June 15 through September 15, no flood control restrictions exist. Full flood reservation space is required from November 17 through February 7. From September 16 through November 16 and from April 20 through May 31, reserved storage space for flood control is a function of the date. Beginning February 8 and continuing through April 20, flood reservation space is a function of both date and wetness.

a. Oroville-Thermalito Complex

DWR proposes to operate the reservoir level to meet the needs of the SWP (i.e., water delivery to irrigation districts, flood control, power generation, recreation, D- 1641 water quality standards for the Delta, and fish and wildlife protection). Flows are released from Oroville primarily through the Edward-Hyatt Powerplant where most flows are then diverted through the Thermalito Power Canal and Powerplant with the exception of 600 cfs diverted to the LFC. The Edward-Hyatt Powerplant and the Thermalito Powerplant are operated in tandem to maximize power generation. During periods of peak power demands, water releases in excess of local and downstream requirements are conserved in storage at Thermalito Forebay and are pumped back during off-peak hours through both Powerplants into Lake Oroville to generate additional power. Pumpback operations only occur when it is economically advantageous and commonly occur during periods when energy, prices are high during on-peak hours of the weekdays and low during the off-peak hours or onn weekends.

(1) ***Feather River minimum stream flows.*** DWR proposes to provide a year-round minimum flow requirement of 600 cfs, in the historical river channel (LFC) of the Feather River, based upon criteria in the 1983 agreement between DWR and DFG (i.e., *Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish and Wildlife).* This eight-mile reach contains the known extent of spring-run Chinook salmon and steelhead spawning and rearing habitat on the Feather River.

DWR also proposes to provide at least the minimum flow requirements that were established in this agreement for the reach of the Feather River downstream of the Thermalito Afterbay to Verona. Minimum flow requirements between the Thermalito Afterbay and Verona vary for different times of the year, but can go as low as 750 cfs when storage falls below 1.5 MAR Typically, SWP releases a monthly average of 1,250 cfs from December through May, with higher flows to meet water contracts during the summer months (i.e., range from 3,000 to 7,000 cfs).

(2) ***Feather River seasonal fluctuations and ramping of stream flows.*** DWR has not proposed any ramping criteria for Oroville releases within the LFC; however, previous interim OCAP opinions have required ramping criteria below 5,000 cfs in the LFC (NOAA Fisheries 2004). Flows below the Thermalito Afterbay, according to the 1983 agreement, when less than 2500 cfs, can not be reduced by more than 200 cfs during any 24-hour period.

(3) ***Feather River temperature control.*** DWR proposes to meet temperature criteria established in the 1983 agreement between DWR and DFG. Varying temperature criteria were specified in the agreement for two different locations; the Feather River Hatchery (FRH), and the reach of the Feather River between the Thermalito Afterbay and Verona. Criteria for the FRH were specified, to provide suitable temperatures within the hatchery for raising Chinook salmon and steelhead The hatchery is located at the upstream end of the LFC; therefore, temperatures within the LFC are influenced by the FRH temperature requirements. Temperature criteria between Thermalito and Verona were specified to provide suitable temperatures during the fall' months (after September 15) for fall-run Chinook salmon and suitable temperatures from May through August for other anadromous species (e.g., American shad and striped bass).

The current water temperature objective for the Feather River LFC is a daily average of 65°F between the Fish Barrier Dam and Robinson Riffle (RM 61.6) for steelhead incubation and rearing from June 1 through September 30 (NOAA Fisheries 2004).

(4) ***Department of Water Resources Fish Studies.*** DWR initiated fisheries studies in 1991 in the LFC. As part of the interim OCAP opinions, DWR was required to report the effects of stranding and isolation resulting from flow fluctuations on listed salmonids (i.e., spring-run Chinook, salmon and steelhead). These studies focused on collecting presence or absence, rearing, spawning, and emigration data in coordination with DFG and NOAA Fisheries. In 2003, the focus and methods of these studies shifted in order to gather information for the upcoming Federal Energy Regulatory Commission (FERC) dam relicensing process. In 2004, NOAA Fisheries consulted with DWR and issued a biological opinion on proposed fish studies specifically designed to meet the needs of the FERC requirements (DWR 2004b).

PAGE 42—J. Interrelated and Interdependent Actions

2. Fish Hatcheries

c. Feather River Fish Hatchery

SWP mitigation for the loss of upstream riverine habitat caused by the construction of Oroville Dam and Thermalito Complex. The hatchery, operated by DFG, annually produces 8 million fall-run Chinook salmon, 5 million spring-run Chinook salmon, and 400,000 steelhead.

PAGE 124—I. Feather River

1. Formal Consultation

Projected Feather River flows and water temperatures are expected to influence the adult migration, spawning, and incubation of spring-run Chinook salmon and steelhead. Long-term average and dry monthly flow projections and modeled water temperatures were used to assess impacts to spring-run Chinook salmon and steelhead. Flow projections and average monthly water temperatures above and below the Thermalito Outlet (i.e., Low-flow Channel and Highflow Channel), for wet and dry water years were compared to the preferred conditions and habitat requirements of Chinook salmon and steelhead during migration, spawning, incubation, rearing, and outmigration. Holding temperatures for spring-run Chinook salmon were also analyzed. Flow and water temperature simulations in the Low-flow Channel were used to evaluate effects to spring-run Chinook salmon holding, spawning, and egg incubation, and steelhead spawning and egg incubation. Chinook salmon mortality was estimated using Reclamation's mortality model (Reclamation 2004a). Where average monthly temperatures or flows exceeded preferred conditions for the species, actual water temperatures and flows were considered if they were available and applicable. Habitat availability and suitability also were assessed using all available instream flow-habitat relationship information, including preliminary reports written for the relicensing of the Oroville Facilities (FERC No. 2100).

a. Adult Migration, Spawning, Incubation

CV spring-run Chinook salmon. Based on observations of spring-run Chinook salmon immigration in the Sacramento River, adults are likely to migrate upstream through the action area during the period between February and July where they hold in deep, coldwater pools until spawning begins in mid- to late August. Most pre-spawning spring-run Chinook salmon adults hold in the upper three miles of the Low-flow Channel below the Fish Barrier Dam (Reclamation 2004a). Temperatures near the upper end of the Low-flow Channel during the summer provide suitable holding conditions throughout the summer months and provide the coldest water available during September for the initiation of spawning. The High-flow Channel is considered a migratory corridor for adult spring-run Chinook salmon, and few, if any of these fish are thought to hold or spawn there. For spring-run Chinook salmon, spawning primarily occurs during September and October and eggs may incubate into December or January '(DWR 1999a,b).

Egg mortality was estimated during the egg incubation period for spring-run Chinook salmon using Reclamation's Salmon Mortality Model (Reclamation 2004). The egg survival model uses Chinook salmon temperature-exposure mortality criteria for three life-stages (i.e., pre-spawned eggs, fertilized eggs, and pre-emergent fy) along with spawning distribution and timing information, and output from the water temperature model. Egg mortality is less than 2.5 percent for all but critically dry years when mortality is about 4.0 percent. The egg survival model does not consider potential egg mortality from fall-run Chinook salmon redd superimposition, and is, therefore, more

applicable as an indicator of water temperature suitability.

Average monthly water temperatures during adult spring-run Chinook salmon migration may range between 50 °F and 70 °F in the High-flow Channel, and between 49 °F and 68 °F in the Low-flow Channel. Monthly water temperatures in the High-flow Channel are predicted to be within the preferred range for adult spring-run Chinook salmon migration from February through May. During June of both wet and dry years, water temperatures in the High-flow Channel may exceed preferred ranges identified by Bell (1991) and Boles (1988), and during July, water temperatures will reach 69 °F to 70 °F, and are likely to block the tail end of adult migration or cause migration delays. In the Low-flow Channel, water temperatures will be in the preferred range for adult spring-run Chinook salmon migration from February through May. During June of dry years, average monthly temperatures will range from 63 °F to 65 °F, near the upper range identified by Boles (1988), but below the temperatures that completely block adult migration. July temperatures will be 68 °F, above the upper limit identified by Boles (1998), but below the temperature that would completely block adult migration. Fish may also experience an increased susceptibility to disease in June and July when water temperatures exceed 65 °F. The use of average monthly water temperatures for forecasting habitat suitability does not forecast diel temperature ranges that may either be higher or lower than those modeled. While actual daytime temperatures in July are likely to exceed the monthly average and block adult migration, evening temperatures may be lower and allow for upstream migration. Consequently, NOAA Fisheries anticipates that the overall effect of water temperatures on adult spring-run Chinook salmon migration is that the tail end of migration upstream during July may experience temporary delays, and an increased susceptibility to disease, but the fish are still expected to reach upstream holding and spawning habitat where cooler water is maintained throughout the adult holding period.

Simulated monthly average water temperatures for holding spring-run Chinook salmon in the Low-flow Channel, during wet and dry years, tend to exceed the preferred range in June, July, August, and September. In previous consultations on the effects of the SWP on the Feather River, NOAA Fisheries has required that to the extent possible, a daily average water temperature of 65 °F be maintained at Robinson Riffle from June 1 to September 30 to protect steelhead. This requirement has resulted in summer water temperatures that are within the preferred range of spring-run Chinook salmon in the upper five miles of the Feather River below the Fish Barrier Dam. Furthermore, actual water temperatures in the upper three miles of river may be as much as five degrees cooler than at the lower end of the Low Flow Channel near Robinson Riffle. Data collected by DWR during the, summer of 1998 show that water temperatures in the upper Low-flow Channel rarely exceeded 60 °F near the hatchery during July and August while water temperatures at Robinson Riffle occasionally exceeded 65 °F for several hours or days at a time. DWR estimates that between 75 and 80 percent of the spring-run Chinook salmon in the Feather River hold in this three miles. Adult spring-run Chinook salmon holding in the lower reaches of the Low-flow Channel are likely to experience monthly water temperatures that exceed preferred temperatures for short durations, typically less than two days. These temperatures may increase the susceptibility of holding spring-run Chinook salmon to disease, and may cause limited

mortality.

The majority of in-river spring-run Chinook salmon spawning is concentrated in the uppermost three miles of accessible habitat in the Feather River below the Feather River Fish Hatchery (DWR 2001), although spawning may extend to the downstream portion of the Low-flow Channel above the Thermalito Afterbay Outlet. Modeled water temperatures for spring-run Chinook salmon spawning exceed preferred levels during September, but are within preferred levels in October and November. Similar to the effect of actual water temperatures on holding spring-run Chinook salmon, water temperatures are expected to be lower than modeled in the upper three miles of river, and be within the preferred range for spawning throughout the spawning period. However, water temperatures at the downstream end of the Low-flow Channel are expected to exceed preferred range for spawning until October. Modeled water temperatures during egg incubation are exceeded during September, but are within the preferred temperature ranges from October through January. Since the majority of spring-run Chinook salmon spawning and rearing is above the downstream end of the Low-flow Channel this is not expected to significantly cause an impact.

River flow and water temperature also can be affected by reservoir carryover storage and by pump-back operations through the Thermalito Complex. Pumpback operations typically occur in the summer or fall during "off-peak" periods. The effects of pump-back operations are most noticeable during extreme drought periods when reservoir storage drops below 1.2 MAF. Lower reservoir elevation causes the cold water level to drop below the power plant intake shutters that provide temperature control during dam releases. However, operational simulations indicate that reservoir carryover storage is unlikely to drop below 1.2 MAF, even under the more conservative 90 percent exceedence forecast. As a result, pump-back operations are not expected to adversely affect anadromous fish in the Low-flow Channel.

For adult upstream migration, spring-run Chinook salmon require stream flows that are sufficient to trigger migration cues and locate natal streams (DFG 1998). Minimum flows in the Feather River were established in a 1983 agreement between DWR and DFG for the preservation of salmon spawning and rearing habitat (see section II. *Description of the Proposed Action).* This agreement established flow criteria for the Low-Flow Channel and the High-flow Channel. The minimum flow releases in the agreement are between 1,200 cfs and 1,700 cfs in the High-flow Channel between October and March, and 1,000 cfs between April and September. A minimum flow of 600 cfs is maintained in the Low-flow Channel.

CV steelhead. Adult steelhead migrate upstream into the Feather River from September through May. The majority of fish migrate from September through February, although recent studies by DWR have identified an adult run that returns during the spring (i.e., April and May), presumably to spawn (DWR 2001). Most steelhead return to the Feather River Fish Hatchery and very limited information exists regarding their location, timing, and magnitude of spawning within the river. Observations to date suggest the Low-flow channel is the primary reach for steelhead spawning, with up to 50 percent of the spawning occurring in the uppermost mile of river

in a side channel adjacent to the Feather River Fish Hatchery (DWR 2003). The remainder of the population spawns downstream, primarily in other side channels within the Low-flow Channel, although it is likely that some steelhead spawn in side channels in the High-flow Channel, as far downstream as Honcut Creek (DWR 2003). Spawning occurs from December through April and peaks in January and February (DWR 2003). Incubation is likely to continue into early May.

Average monthly water temperatures during the peak adult steelhead migration period of September through January range from 45 °F to 65 °F in the High-flow Channel and 46 °F to 61 °F in the Low-flow Channel. Preferred migration temperatures are exceeded in September and early October, but are within the preferred range during the remainder of the migration. Water temperatures during the spring migration period are slightly higher than the primary migration and range from 50'F to 60,017. Preferred migration temperatures are exceeded in May, but are not expected to alter fish behavior or stress adults.

During the steelhead spawning and egg incubation period, average monthly water temperatures in the Low-flow Channel range from 46 °F to 55 °F. Temperatures are within the preferred range for spawning from December through March, but exceed the preferred range in April (i.e., 53 °F to 55 °F) and May (60 °F). Actual water temperatures in the upper Low-flow Channel, where most spawning is concentrated, may be lower, and closer to the preferred range because of the proximity of this habitat to the cold water releases of Oroville Dam. Average monthly water temperatures in May are 60 °F and exceed the preferred levels for steelhead spawning, but are not expected to be significant since very few adults spawn that late.

Projected average monthly flows in the High-flow Channel during the steelhead and spring-run Chinook salmon migration period range from approximately 1,500 cfs during dry years to 12,300 cfs during wet years. A constant flow of 600 cfs will be released into the Low-flow Channel. These flows are expected to provide adequate depths and velocities for upstream migration. Spawning flows were evaluated by DWR in a recent flow-habitat relationship study (DWR 2004a,b). The results of the study indicate that there is little change in weighted useable area (WUA) expressed as units of square feet per 1000 linear feet or relative suitability index (RSI) at different flows, and that optimum levels are achieved at lower flows than for Chinook salmon. However, the maximum WUA/RSI in the Low-flow Channel appears to be between 450 cfs and 700 CFS. In the High-flow Channel the maximum WUA/RSI is achieved between 800 cfs and 1,000 cfs and quickly drops after approximately 1,800 cfs.

Flows generally will remain stable during steelhead and spring-run Chinook salmon egg incubation, but may periodically be increased above standard forecasts during December and January for flood control or to meet Safety of Dams Criteria. Oroville Dam releases in excess of 17,000 cfs must be released to the Low-flow Channel. Short duration, high flow events can scour steelhead redds and result in the injury and mortality of incubating eggs. While DWR and Reclamation do not provide estimates of flows that trigger bedload mobility and cause redd scour, they mention that the last bed-mobilizing flow occurred in 1997, and that subsequent flows up to 25,000 cfs have not

mobilized the bed. This suggests that redd scour is not likely to occur at flows below 25,000 cfs. In the Low-flow Channel, where a majority of the spawning and egg incubation occurs, flows will remain at 600 cfs under all but critically dry years in December and January. In the High-flow Channel, where little, if any spawning occurs, flows are only expected to exceed 25,000 in December and January under the three to five percent exceedence forecast. These flow conditions will avoid scouring and dewatering of redds under standard operations.

Steelhead redd dewatering can occur when river flows are reduced during or after the spawning period and also can result in injury and mortality of incubating eggs. In the Low-flow Channel, where a majority of the spawning and egg incubation occurs, flows will remain at 600 cfs under all but the 10 percent exceedence forecast from January to May. These flow conditions will avoid scouring and dewatering of redds in the Low-flow Channel under normal operations in most years. In the High-flow Channel, the frequency of flow fluctuations is greater than in the Low-flow Channel and steelhead redds may be dewatered when periodic high releases return to forecasted levels. Flow fluctuations for flood control have dewatered Chinook salmon redds in the past, but surveys have not detected any dewatered steelhead redds. However, if steelhead redds are dewatered in the High-flow Channel, the effect is probably insignificant to the population since the majority of steelhead spawning takes place in the Low-flow Channel.

b. Fry and Juveniles

CV spring-run Chinook salmon. Spring-run Chinook salmon fry emerge from redds from December through January. Results from Feather River Chinook salmon emigration studies indicate virtually all spring-run Chinook juveniles in the Feather River exit as sub-yearlings. Emigration begins immediately following emergence in late November, peaks in January and February, and continues through June (DWR 1999a,b,c). Although most juvenile Chinook salmon are believed to have outmigrated through the High-flow Channel by early April, snorkel surveys have confirmed that as many as 500,000 juvenile salmon continue to rear in the Feather River throughout the summer, mostly in the Low-flow Channel, and are likely to outmigrate the following fall as yearlings (DWR 2003). Water temperatures necessary for maximum growth and development are from 53 °F to 57.5 °F, although temperatures up to 65 °F can be tolerated without adverse effects (Boles 1988).

Average monthly water temperatures during spring-run Chinook salmon juvenile rearing and outmigration range from 48 °F to 67 °F in the High-flow Channel and 45 °F to 65 °F in the Lowflow Channel. Water temperatures during the peak emigration period range from 45 °F to 50 °F. Temperatures are within the preferred range for growth and development during all months except May and June where temperatures may exceed preferred levels but generally remain below levels that cause adverse effects.

Flood control operations above 5,000 cfs may result in rapid and large flow fluctuations within the Lower Feather River. Depending on the magnitude and/or duration of these flow fluctuations, there is a potential for fry and juvenile Chinook salmon to become

stranded. Ramping criteria for the Feather River were established by a 1983 agreement between DWR and DFG. This agreement requires flows below the Thermalito Afterbay that are under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood control. This ramping rate is expected to minimize impacts to juvenile spring-run Chinook salmon from stranding in the High-flow Channel. Past flow fluctuations for flood control or dam safety inspections have resulted in fry and juvenile Chinook salmon being stranded in the High-flow Channel and the Low-flow Channel. DWR engineers estimated that dam safety inspections are likely to occur on average every year and more frequently as the facility ages in the future. In February 2004, a safety inspection on the Thermolito Outlet caused stranding of juvenile salmon in the Low Flow Channel (DWR 2004 and DFG 2004). In 2001, DWR reported 23 redds dewatered and estimated 2,500 spring-run sized juvenile salmon were stranded between January and May in the High-flow Channel (DWR 2002b). DWR assumes that rearing juveniles are susceptible to stranding in the High-flow Channel when flows decrease by more than one-half over a seven day period when flows fluctuate between 8,000 cfs and 1,000 cfs. Since 1980, such conditions have occurred sixteen times in 21 years during the January through June rearing season. The significance of these stranding losses to the spring-run Chinook salmon population in the Feather River is unknown because it is difficult to truly distinguish the difference between fall-run and spring-run Chinook salmon due to the extensive overlap in spawning timing and distribution. However, if all 2,500 juveniles reported stranded in 2001 were spring-run Chinook salmon the effect of frequent recurring flow fluctuations would be significant to the Feather River population.

Based on rotary screw trap captures, there does not appear to be a relationship between flow and juvenile Chinook salmon outmigration rates (DWR 2002c). Fry passage at the rotary screw trap in the Low-flow Channel varies considerably over time while flows remain constant at 600. cfs. Similarly, at the Live Oak rotary screw trap in the High-flow Channel, where there is considerable flow fluctuation, outmigration rates do not correlate with flow increases.

CV steelhead. Steelhead fly and juveniles have been captured in Feather River Chinook salmon emigration studies since 1995. Young-of-the-year (YOY) were captured from March through June, while yearlings were captured from January through June. Steelhead were not captured during the period between October and December, but it was speculated that this may have occurred because the sampling gear may not be able to detect their presence during this time (DWR1999a, b, c). Based on these results and steelhead emigration patterns in the Sacramento River, steelhead juveniles and smolts are expected to emigrate from the Feather River from December through March. Fry and juvenile steelhead water temperature necessary for maximum growth and development are from 45 °F to 65 °F (McEwan and Jackson 1996; Myrick and Cech 2001).

Average monthly water temperatures during juvenile rearing periods exceed preferred levels (i.e., greater than 65 °F) in June, July, and August. Water temperatures that exceed preferred ranges can cause thermal stress. Thermal stress induces varying degrees of physiological responses that may harm or kill juvenile steelhead by reducing

their growth, and increasing their susceptibility to disease and predation. Recent temperature studies on the Feather River indicate that steelhead rear successfully at the downstream end of the Low-flow Channel where temperatures exceed 65 °F. Additionally, a laboratory study on Feather River steelhead found that naturally produced steelhead juveniles displayed a higher thermal tolerance than steelhead from the Feather River Hatchery. These studies suggest that steelhead may not be harmed or killed by forecasted summer water temperatures. During the remainder of the year, and throughout the juvenile outmigration period, water temperatures are either within the preferred range for growth and development or below levels that cause adverse effects.

There currently is little information available to assess the effect of flow on steelhead outmigration. Very few steelhead are captured in the rotary screw traps in the High-flow Channel and the Low-flow Channel, and steelhead are thought to be more efficient at avoiding capture because of their larger size and better swimming ability (DWR 2002). However, based on the information currently available, flow has not proven to be significant in stimulating outmigration.

Depending on the magnitude and/or duration of flow fluctuations for flood control or dam safety, there is a potential for fry and juvenile steelhead to become stranded. The 1983 ramping rate agreement between DWR and DFG is expected to minimize impacts to steelhead from and juveniles from stranding in the High-flow Channel. Past flow fluctuations for flood control or dam safety inspections have resulted in fry and juvenile steelhead being stranded in both the High-flow Channel and Low-flow Channel. DWR engineers estimated that dam safety inspections are likely to occur on average every year and more frequently as the facility ages in the future. In February 2004, a safety inspection on the Thermolito Outlet caused stranding of juvenile steelhead in the Low Flow Channel (DWR 2004 and DFG 2004). In 2001, DWR estimated 40 juvenile steelhead were stranded in one out of nine ponds between January and May in the High-flow Channel (DWR 2002a). DWR assumes that rearing juveniles are susceptible to stranding in the High-flow Channel when flows decrease by more than one-half over a seven day period when flows fluctuate between 8,000 cfs and 1,000 cfs. Since 1980, such conditions have occurred sixteen times in the January through June rearing season. The abundance of naturally produced juvenile steelhead is low (DWR 2003), so frequent flow reductions may have a significant impact on the number of juveniles produced in the Feather River.

c. Habitat Availability and Suitability

In addition to the temperature and flow-related effects of the Project on the life history stages discussed above, operations also affect overall habitat availability and suitability. Flows affect the amount of habitat available for adult spawning for all salmonids in the system, which in turn affects reproductive success since the spawning and rearing habitat is limited and redd superimposition is occurring. Changes in the amount of habitat for fry and juvenile rearing may affect growth and survival.

A 1994 flow-habitat simulation study conducted by DWR suggests that the maximum

area of suitable Chinook salmon spawning habitat occurs at flows of approximately 1,000 cfs in the Low-flow Channel. DWR recently completed an updated flow-habitat relationship study (i.e., using PHABSIM) at the recommendation of the Feather River Environmental Working Group (EWG), a collaborative team that has formed to address anadromous fishery issues related to the Federal Energy Regulatory Commission's (FERC) relicensing of the Oroville Facilities (DWR 2004a). The results of this study demonstrate that the maximum WUA/RSI for Chinook salmon spawning in the Low-flow Channel is achieved at a flow between 800 cfs and 825 cfs. Reclamation asserts that spawning spring-run Chinook salmon are unlikely to be directly impacted by the amount of space available for spawning since they are the first Chinook salmon run to begin spawning, and there appears to be an adequate amount of spawning habitat to support the current population.

Redd superimposition by fall-run Chinook salmon, which spawn later and in much greater numbers, could be causing substantial egg mortality (Sommer et al. 2001). This is significant due to the complete spatial overlap of fall and spring-run Chinook salmon spawning, and is likely to result in a high rate of redd superimposition. Since the majority of spring-run Chinook salmon in the Feather River spawn in the uppermost three miles of habitat and fall-run Chinook salmon use the same area it is likely that this habitat is being over-utilized. Sommer et al. (2001) observed that since the completion of Oroville Dam, there has been a shift in the distribution. of Chinook salmon spawning from the High-flow Channel, and superimposition of redds in the Low-flow Channel is a major problem. However, Sommer et al. (2001) suggest that increasing flow in the Low-flow Channel to provide more spawning habitat may actually increase superimposition rates by attracting more fall-run Chinook salmon. Due to the combined effects of run hybridization, limited amount of spawning habitat (upper three miles of the LFC), and spatial and temporal overlap with fall-run Chinook salmon, Feather River spring-run Chinook salmon are not able to persist into the future as an independent population that is -genetically distinct from fall-run Chinook salmon, unless they can be geographically segregated (Lindley 2004).

DWR holds a license for Oroville from FERC, which is currently undergoing review in the context of a relicensing proceeding. In the FERC relicensing proceeding, the effects of Oroville Dam and its operations on listed species will be considered, and NOAA Fisheries will have the opportunity to develop recommendations to avoid or mitigate adverse effects on listed species not only through the ESA but through the additional authorities granted to NOAA Fisheries under the Federal Power Act. NOAA has broad authority to prescribe fish passage measures under section 18 of the Federal Power Act and to recommend measures to improve or maintain habitat downstream of a dam pursuant to section 10(j) of the FPA. As part of the FERC relicensing process, DWR is completing studies and developing measures to address these issues.

Preliminary results of the PHABSIM studies on the Lower Feather River provide some insight on the effect of forecasted flows on Chinook salmon and steelhead rearing (DWR 2004b). For Chinook salmon and steelhead fry (i.e., less than 50 mm), WUA/RSI increases proportionally with flow in both the High-flow Channel and the Low-flow Channel from 500 cfs to 7,000 cfs. For Chinook salmon and steelhead juveniles (i.e.,

greater than 50 mm) WUA/RSI values vary depending upon how cover is valued for habitat suitability, but generally increases with more ' flow between 300 cfs and 3,000 cfs in the Low-flow Channel, and 400 cfs and 7,000 cfs in the High-flow Channel. Minor variations in the indices within the total flow range are a result of variability in channel margin areas (DWR 2004b). In all cases, forecasted project flows are at the lower range of modeled habitat availability and provide the least amount of rearing habitat for' juveniles compared to modeled habitat available at higher flows. Therefore, predicted project flows will limit habitat availability. Habitat suitability indices generally indicate that habitat for both species reaches optimum suitability at flows of 1,000 cfs in the Low-flow Channel, and 3,000 cfs in the High-flow Channel.

The presence and current operation of the Oroville Facilities has eliminated the contribution of bed material from the upper watershed, and regulated flows from Oroville Dam have dampened the magnitude and frequency of low and high flow events downstream (DWR 2001). A reduction in overbank flooding, combined with the elimination of upstream bed material, halts natural sedimentation processes and contributes to channel degradation. The resulting substrate in the Lower Feather River is armored by cobbles and boulders, mainly due to the lack of gravel recruitment to riffles since the 1960s, when Oroville Dam was completed. Substrate evaluations using Wolman counts show that spawning gravel in the Low-flow Channel has become progressively armored over the past 16 years (Sommer et al. 2001). It is likely that the amount and quality of spawning gravel in the Low-flow Channel will continue to decline as flood flows move gravel downstream over time. NOAA Fisheries anticipates that as spawning gravel is reduced in supply, competition for spawning habitat will increase, resulting in increased levels of redd superimposition, and reduced levels of spawning success and egg survival.

As previously discussed, spring-run Chinook salmon and steelhead spawning habitat availability primarily is confined to the Low-flow Channel. Although the approximately seven miles of holding and spawning habitat appears adequate to support a large number of spring-run Chinook salmon, the suitability of the spawning habitat is diminished because this habitat is also utilized by a large population of fall-run Chinook salmon. The co-occurrence of these species in the same spawning habitat adversely affects spring-run Chinook salmon through redd superimposition and resultant egg mortality, and genetic homogenization through interbreeding (Sommer *et al.* 2001).

Most steelhead spawning and early rearing appears to occur in the Low-flow Channel in habitats associated with well-vegetated side channels (Cavallo et al. 2003). Recent steelhead redd surveys (DWR 2003) found that nearly half of all redds were constructed in the one mile immediately below the Fish Barrier Dam, and recent snorkel surveys by DWR show that most newly emerged steelhead fry are rearing in the uppermost portions of the Low-flow Channel (Cavallo et al. 2003). The remaining majority of spawning and rearing primarily occurs in one additional side-channel riffle complex toward the downstream end of the Low-flow Channel. IFIM results for adult steelhead indicated that the low magnitude and peak in spawning WUA/RSI was attributable to the relative scarcity of smaller substrate particle sizes utilized by spawning steelhead (DWR 2002). In 2003, fewer than 200 adults were estimated to have spawned in the Feather

River. Both spawning and rearing habitats for steelhead are confined to a only few areas in the Lower Feather River. This lack of available spawning and rearing habitat is likely limiting natural steelhead production and juvenile rearing success.

Fish monitoring in the Feather River will continue to capture steelhead and spring-run Chinook salmon. DWR is likely to modify and perhaps expand on such activities to gather information needed by NOAA Fisheries and DFG with the FERC. Additional studies required through the FERC process were permitted in a separate biological opinion that assessed the effects of expanded monitoring (NOAA Fisheries 2004).

Steelhead and spring-run Chinook salmon capture occurs during rotary screw trap sampling, fyke net sampling, beach seine sampling, or snorkeling. Low numbers of steelhead typically are captured in the rotary screw traps between February and July. The total annual steelhead captured in the Feather River fish monitoring program is estimated to be 7,855 fish (i.e., 6,835 YOY, 980 juveniles, and 40,adults), and the total annual potential spring-run Chinook salmon captured is estimated to be 6,500 fish (i.e., 6,355 YOY, 146 juveniles (age unknown), and seven adults). Total annual mortality is estimated to be two percent, or 157 steelhead and 130 springrun Chinook salmon. These estimates are based on the largest seasonal -catch to date and the relative proportions of the different life stages in the catch combined with the estimate.of capture for the sampling elements.

2. Early Consultation

Increased Banks export capacity to 8500 cfs and EWA actions in the future CALSIM model studies 4 and 5 increase the ability to draw down Oroville Reservoir to lower carryover storage levels than existing operations. CALSIM studies 4 and 5 shift releases from winter (i.e., December to March) to summer months (i.e., June to August) in wetter year types, resulting in higher summer flows and lower winter flows. Average monthly summer flow increases are expected to range from a few hundred to 1,500 cfs. Under dry year types average monthly winter flow are almost identical to existing operations, except in July, where flows are slightly higher (i.e., as much as 500 cfs higher) and August and September, where flows are lower (i.e., as much as 500 cfs lower).

Feather River releases in CALSIM studies 4 and 5 only are expected to affect the High-flow Channel because flows in the Low-flow Channel are kept at a constant 600 cfs all year. Effects of future flows are likely to benefit spring-run Chinook salmon and steelhead in wet years because flows will probably provide improved attraction conditions for upstream migration. Lower than existing flows in the winter are not expected to affect adult steelhead migration because adequate depths and velocities for upstream movement will still be met. Lower flows in August and September of dry year types will not affect spring-run Chinook salmon and steelhead, because these flows generally do not correspond with the use of the High-flow Channel by these species. Future flows are not likely to have any impact on spring-run Chinook salmon and steelhead adult holding, spawning, or egg incubation because these life history stages primarily occur in the Low-flow Channel where changes to the existing flow regime are

not expected.

Reduced winter flows may have a greater adverse effect on fry and juvenile rearing and outmigration than existing operations because reduced winter flows correspond with peak migration periods. Although DWR (2002) has not observed any flow-related responses to juvenile outmigration rates, it is likely that lower monthly flows will result in slower water velocities, which may slow salmon and steelhead travel time and make them more susceptible to predation and unscreened diversions in the High-flow Channel, resulting inlower survival rates.

Average monthly water temperatures in the High-flow Channel will be reduced from June to August in wet years. Dry year types will be similar to existing conditions. Cooler water temperatures are expected to provide improved migration conditions for adult spring-run Chinook salmon and may improve summer rearing conditions for juvenile Chinook salmon and steelhead residing in the Low-flow Channel.

Average monthly water temperatures in the Low-flow Channel are not expected to change from existing conditions. Water temperature effects to spring-run Chinook salmon and steelhead will be similar to those analyzed for existing operations under CALSIM studies 1 through 3. Overall, early consultation effects are expected to be similar to the formal consultation, except that reduced storage in Oroville Reservoir will reduce the ability to manage cold water reserves in the late summer, early fall months. This will increase the mortality of over-summering juvenile steelhead and spring-run Chinook salmon.

PAGE 167—Interrelated and Interdependent Effects

1. Hatcheries

(4) Feather River Hatchery

Steelhead are severely limited by a lack of habitat in the lower Feather River basin, and there is no passage to historical habitat above Oroville Dam (DWR 2003). Entrapment prevents gravel replenishment below the dam, decreasing spawning habitat over time. A 2003-04 steelhead redd survey found 75 redds in the upper reaches below the dam, and estimated 163 naturallyspawning steelhead in the river (DWR 2003). The contribution of hatchery steelhead to the naturally spawning population is not known, but as Feather River Hatchery (FRH) returns numbered 2,999 fin-clipped steelhead and no more than five non-clipped fish in 2003-04, it is likely that the majority of in-stream spawners were of hatchery-origin. The FRH produces 450,000 steelhead, six million fall-run Chinook salmon, and two to five million spring-run Chinook salmon. The Feather River spring- and fall-run Chinook salmon have genetically introgressed and express mixed run-timings, now delineated as "early- and late-running" (BRT 2003). As of 2002, 100 percent of the hatchery spring-run Chinook salmon are externally adipose fin-clipped and coded-wire tagged prior to release, as is approximately five percent of the hatchery fall-run Chinook salmon production. All steelhead and half of the spring-

run Chinook salmon production are released in-river. The remaining spring-run and fall-run Chinook salmon production is trucked to San Pablo Bay for release. FRH has begun a process of developing distinct run timings for Feather River fall- and spring-run Chinook salmon through broodstock management. Physical isolation of the spring-run and fall-run Chinook salmon through the placement of an in-river weir or by passage around Oroville Dam is being analyzed within the FERC relicensing process for the Oroville Project. FERC is also expected to initiate an ESA section 7(a)(2) consultation with NOAA Fisheries on the effects of the hatchery programs and infrastructure on listed species.

PAGE 171—Interrelated and Interdependent Effects

3. FERC Relicensing Process/Feather River

DWR has completed an Initial Settlement Agreement with FERC in 2004 for the relicensing of the Oroville Dam Power Plant. The 30to 50 year term of license is due to be completed in 2007. This process is expected to initiate its own ESA section 7 consultation of the effects of the Oroville Dam Project No. 2100. Even though the ESA consultation has not yet begun, preliminary studies have been proposed to determine the how the Oroville Project will affect flows, temperature, gravel, recreation, and the hatchery mitigation program for the lower Feather River. These study proposals have been reviewed and coordinated with studies required for the OCAP consultation dealing with operations (i.e., DWR salmon and steelhead monitoring, stranding and isolation studies, etc.). A. separate biological opinion covering the incidental take for the FERC-related studies was completed in 2004 (NOAA Fisheries 2004).

Proposed studies under the FERC relicensing process have a much broader scope than the studies under the ESA consultation, including areas above and below the dam. In the lower Feather River, DWR has included the following studies which overlap with the ESA consultation; 1) flow and temperature modeling, 2) gravel augmentation, 3) large woody debris studies, 4) a fish weir to separate spring-run from fall-run Chinook salmon spawners, and 5) evaluation of fish passage to determine the feasibility of re-introducing anadromous fish above Lake Oroville (DWR 2004a).

The fish passage evaluation proposal was rejected by DWR in favor of improving existing habitat in the lower Feather River. However, an assessment of the benefits to anadromous fish of improving the habitat in the lower Feather River has not been proposed. To date, preliminary DWR modeling suggests that water temperature control can not be extended further downstream than the existing criteria without major changes to Project operations such as: use of the river outlets, or reconfiguring water conveyance through the Thermalito Afterbay. Alternative operations that improve the suitability of habitat will be assessed through the FERC studies.

Gravel augmentation or improvement of existing spawning areas has not been conducted in the Feather River since 1987 (Stillwater 2004). DWR under the FERC

process has proposed to improve the quantity and quality of spawning habitat' for spring-run Chinook salmon and steelhead by adding gravels in the lower Feather River. The program would then be reviewed every 5 years.

Overall, the proposed FERC studies and projects are expected to provide beneficial impacts to spring-run Chinook salmon and steelhead; therefore, no adverse impacts are anticipated from the FERC relicensing studies. The Oroville Project will be reviewed under a separate section 7 consultation at the time of license application.

PAGE 185—N. EARLY CONSULTATION EFFECTS

6. Feather River

Year-round flows of 600 cfs in the Low Flow Channel of the Feather River will continue to maintain approximately five miles of habitat with preferred water temperatures for holding, spawning, and rearing spring-run Chinook salmon and steelhead. The Low Flow Channel is utilized by approximately 70 percent of the spawning populations of Chinook salmon and steelhead in the Feather River. Although preferred water temperatures within this five mile reach are met at a year round flow of 600 cfs, rearing habitat suitability for fry and juveniles is limited; especially for steelhead because only three riffle complexes are known to support summer rearing. Habitat suitability indices generally indicate that rearing habitat for both species reaches maximum suitability at flows of 1,000 cfs in the Low Flow Channel.

Flow fluctuations for flood control or dam safety inspections are expected to result in fry and juvenile spring-run Chinook salmon and steelhead being stranded in both the High-flow Channel and Low-flow Channel. These fluctuations are expected to occur on average every year and more frequently as the facility ages.

PAGE 192—C. INTERRELATED AND INTERDEPENDENT ACTIONS

1. Hatcheries

Specific information on the effects of each hatchery was not available for this consultation. NOAA Fisheries expects the effects of hatchery activities on listed salmonids to be addressed in more detail in a future consultation. Generally, hatcheries within the action area (i.e., Trinity River, Livingston Stone, Coleman, Feather River, and Nimbus) were established on Project streams as mitigation for habitat lost upstream of high dams. However, hatchery operations can also negatively affect the viability of natural fish populations through such mechanisms as the introduction of exotic strains of diseases, hybridization of hatchery fish with native local stocks of fish, and domestication (i.e., selection for genetic traits advantageous in a hatchery setting and accompanied by a loss of fitness for natural rearing). Hatchery fish may increase the abundance of fish numbers, but there is evidence to demonstrate that they are not as productive or genetically fit in the natural environment as fish under natural selection (Chilcote 2003, et al. 1986; Berejikian et al. 1999; Fleming et al. 1993, Unwin 1997).

For winter-run Chinook salmon, artificial propagation was identified as a necessary restoration action to prevent the extinction of the ESU, and so may be viewed as beneficial. However, for the other ESUs considered in this opinion, the naturally-spawning populations in Project streams are dominated by hatchery fish, due almost always to a scarcity of suitable spawning habitat coupled with production of large numbers of hatchery fish. NOAA Fisheries believes this to be a stressor for steelhead populations in virtually all project streams due to the very low numbers of naturally spawning fish (e.g., fewer than 200 on the Feather River), which can easily be overwhelmed genetically by hatchery fish. For spring-run Chinook salmon, NOAA Fisheries anticipates that the naturally-spawning population will be lost on the Feather River due to introgression with hatchery-produced fall-run Chinook salmon.

PAGE 197—D. Population Impacts and Potential for Recovery

2. Central Valley Spring-run Chinook Salmon

Overall abundance in this ESU is low (Figure B2), but has increased since 1992 due to a large increase in spawning in three key tributaries (i.e., Deer, Mill and Butte Creek). Population growth rates (?,) in these three tributaries are estimated at 1.17 (95 percent CI: 1.04, 1.35), 1.19 (1.00, 1.47), and 1.30 (1.09, 1.60), respectively (NOAA Fisheries 2003). The Butte Creek population may be at or near carrying capacity levels. The Deer and Mill Creek populations appear to be recovering to population levels similar to those seen in the 1940s and 1950s (Grower *et al.* 2004) On Clear Creek, small numbers of adults (i.e., less than 50) have started to return due the removal of a diversion dam and improved operations (e.g., flows and water temperatures).

The increase in population abundance in the tributaries masks the significant decline in the portions of the population residing in the mainstem Sacramento River and the Feather River; two rivers that were significant portions of the ESU. These populations have been declining due to hybridization with fall-run Chinook salmon and unsuitable habitat conditions caused by operations (i.e., lack of cold water in September, flow fluctuations, redd dewatering, and lack of over-summer habitat for adults and juveniles). The Feather River and mainstem Sacramento River spring-run Chinook salmon populations probably represent 20-30 percent of the current total population (i.e.,10,000-13,000 adults; DFG 2004c); historically, these two areas represented approximately 60 percent of the population based on DFG counts from 1964-1980. For example, the spawning population in the Sacramento River above RBDD was estimated at 23,156 fish in 1982. DFG biologists believe that the spring-run Chinook salmon population has nearly disappeared from the mainstem Sacramento River (DFG 1998). Genetic analyses (Lindley et al. 2004), the existence of a springtime freshwater entry, and the potential for segregation of naturally-spawning spring-run fish in the Feather River system suggest that rescue of a spring-run may be possible. The conclusion of the Technical Recovery Team for the Central Valley was that this phenotype will not persist without immediate and direct intervention to preserve the genetic basis for spring run timing and that the Feather River population should be conserved because it may be all that is left of and important component of the ESU (Lindley et al. 2004).

Spatial structure of the spring-run Chinook salmon ESU is very limited. As discussed above, populations exist in Deer, Mill and Butte Creeks. Limited habitat exists in the remainder of the smaller tributaries like Antelope Creek, Beegum Creek, and Big Chico Creek, which can only produce small numbers of fish. In the upper Sacramento River, RBDD blocks or delays adults from re-establishing populations in the only available habitat for recovery (i.e., Battle Creek).

On average, proposed Project operation impacts in the upstream areas of the Sacramento River are likely to reduce the mainstem Sacramento River juvenile spring-run Chinook salmon population by 4 percent over current conditions in most years, increasing total loss to 25 percent of the mainstem juvenile population (Tables 9 and 10). Project operations will continue to block and delay adults at RBDD and increase water temperatures in the upper Sacramento River during spawning (resulting in an egg and larval mortality rate of 21 percent on average and 82 percent in critically dry years, an increase of 6 percent over the baseline). Project related losses are expected to continue into the future under formal and early consultation and prevent the species from expanding it's distribution unless new areas can be restored (e.g. Battle Creek) or passage around Project dams can be achieved. Adaptive management is expected to reduce some of these impacts, however issues like water temperature effects are difficult to resolve for springrun Chinook salmon based on their spawning timing in late summer and fall when cold water storage levels are low. We expect that proposed operations will continue the decline of the mainstem population and likely lead to its extirpation. In the Delta, project operations are expected to increase loss of juveniles 4 to 21 percent over baseline conditions, increasing total Delta effects to 39 to 60 percent of all juveniles entering the Delta from Central Valley rivers. In the Feather River, project operations are expected to provide generally adequate flows and temperatures for spring-run Chinook salmon spawning, incubation, and rearing. Rearing habitat will remain at current levels of suitability and availability, potentially affecting the population's ability to increase. In addition, flow fluctuations in both the High Flow Channel and Low Flow Channel are expected to result in the stranding of juveniles. We cannot quantify the effect of these losses on the population, but the expected increase in frequency of flow fluctuations due to safety inspections over the coming years is likely to harm the population.

Project operations in the Feather River are not expected to increase the primary threat to springrun Chinook salmon in that river: redd super-imposition by fall-run Chinook salmon and hybridization with hatchery fish. Nor are project operations expected to reduce these threats.

Overall, Feather River operations are expected to result in an increase of the population's vulnerability to extinction due to chronic losses of juveniles due to flow fluctuations. However, we cannot measure or quantify this increase due to uncertainty in both the frequency with which flow fluctuations will occur and the number or proportion of spring-run Chinook salmon juveniles that may be stranded.

Harm to the Feather River population and loss of the mainstem Sacramento River population due to the direct and indirect effects of Project operations, are expected to

reduce the ESU's numbers, reproduction, and distribution. Continuation of and, in some cases, increases in the adverse direct and indirect effects of Project operations are expected to increase the probability of extinction of the Feather River and Sacramento River populations with little chance of recovery or re-establishment without implementation of other recovery measures. Given the apparently robust nature of the Deer, Mill, and Butte Creek populations, increases in the Feather River and Sacramento River's already high probabilities of extinction are not likely to measurably change the overall ESU's probability of extinction based on the proportional relationship between local and regional probabilities of persistence in species. However, the vulnerability of these populations will be problematic for recovery efforts and may require future operational changes to aid in the recovery or re-establishment of these populations.

PAGE 199—D. POPULATION IMPACTS AND POTENTIAL FOR RECOVERY

4. Central Valley Steelhead

The Central Valley steelhead ESU has been reduced to small, remnant populations both inside and outside the Project action area, and the most recent available data indicate that the natural population is continuing to decline and that hatchery steelhead dominate the catch entering the Bay-Delta region. For steelhead, the limited habitat below Project dams has declined in quality to a point where it can only support low population levels. Abundance estimates for'steelhead in three of the five Project rivers in the action area (i.e., the Stanislaus, Feather, and American Rivers) presently are so low that continued viability of the populations is questionable (McElhany et al. 2000). The resilience of these populations to further adverse impacts is likely to be impaired. The Clear Creek population may be increasing in abundance due to dam removal and restoration efforts. Recent spawning surveys of small Sacramento River tributaries (Deer, Mill, Antelope, Clear, and Beegum Creeks (Moore 2001)) and incidental capture of juvenile steelhead during Chinook monitoring (Calaveras, Cosumnes, Stanislaus, Tuolumne and Merced Rivers) have confirmed that steelhead are widespread throughout accessible streams and rivers (NOAA Fisheries 2003).

Productivity for steelhead is dependent on freshwater survival and over summering habitat which has been reduced by 95 percent in the baseline. There is no commercial or sport harvest and ocean conditions are assumed favorable; therefore, the decline in abundance is attributed to impacts in the freshwater life stages. This species is subject to greater in river mortality than most salmon species due to an extended fresh water life history (Meehan and Bjornn 1991). In order to compensate for this, steelhead have the ability to spawn more than once and use intermittent streams. Productivity is low due to the lack of remaining suitable habitat in river reaches that historically were used as migratory habitat. The Biological Review Team concluded the steelhead mean annual population growth rate is less than one (A = 0.95, with confidence interval 0.90 tol.02) and the 5 year mean is 1,952 adults (NOAA Fisheries 2003). Estimates based on juvenile production indicate that the wild population may number and average of 3,628 female spawners (NOAA Fisheries 2003). On the Stanislaus River, less than 50 smolts are reported each year (Demko 2000). On the San Joaquin River, less than ten

smolts are observed each year in the lower river (Mossdale trawl data Figure B4). On the Sacramento River, juvenile abundance has declined since the early 1990's at the Knight's Landing, Sacramento, and Chipps Island monitoring stations (Reclamation 2004).

Spatial structure for steelhead is fragmented and reduced by elimination or significant reduction of the major core populations (i.e. Sacramento River, Feather River, American River) that provided a source for the numerous smaller tributary and intermittent stream populations like Dry Creek, Auburn Ravine, Yuba River, Deer Creek, Mill Creek, and Antelope Creek. Tributary populations can likely never achieve the size and variability of the core populations in the longterm, generally due to the size and available resources of the tributaries. Steelhead redd and juvenile rearing surveys in the Feather River (DWR 2003, Cavallo et al., 2003) indicate that spawning and rearing habitat is limited and primarily exists at only two locations; one at the upstream end of the Low-flow Channel, and one at the downstream extent of the Low-flow Channel. This limited amount of available habitat is likely to limit juvenile production and the carrying capacity for steelhead fry and juvenile rearing. Furthermore, the minimal population estimate of less than 200 spawning adults in this river is below established levels that are considered to be viable to ensure the continued existence of the species (NOAA Fisheries 1997, Botsford and Brittnacher 1998).

NOAA Fisheries does not know how many steelhead spawn in the upper Sacramento River since they cannot be distinguished from the sizable resident trout population that has developed as a result of managing for cold water all summer. NOAA Fisheries assumes that most of the adult steelhead passing RBDD spawn in tributaries since the habitat is more suitable. In addition, the loss of riparian habitat due to the cumulative effect of urban growth and development is expected to reduce the number of smaller streams in the Central Valley that contain isolated populations of steelhead. Finally, the Central Valley steelhead ESU has become less diverse through the introduction and reliance on out-of-basin stocks of hatchery produced fish, and the loss of the San Joaquin population due to low flows and diversions.

Other factors that adversely affect critical habitat are the reduction in long-term average Delta outflow (2 percent on average decrease) and return flows from CVP contractors. Reductions in Delta outflow are a direct result of increased pumping rates in the winter months (i.e., October through March) when salmonids are present. The abundance or survival of Chinook salmon and estuarine-dependent species has been shown to increase with freshwater outflow (Kjelson 1981, Kimmerer 2002). The value of Delta habitat for salmonid emigration and rearing is protected by the standards in the State Water Quality Control Plan. As long as the water projects comply with these standards, these values should be protected. The suitability and function of rearing areas are degraded by the return of irrigation water in the fall when the peak of juvenile winter-run Chinook salmon emigration occurs in the Sacramento River. Agricultural return water resulting from the diversion of CVP contract water at numerous points along the Sacramento River creates poor water quality conditions for out-migrants by exposure to high water temperatures, pesticides, and contaminants. Essential features of critical habitat that are degraded due to this action include water, space, cover, and rearing

along approximately 200 miles of mainstem, river. This impact has been occurring since the designation of critical habitat and is expected to continue at similar levels into the foreseeable future.

NOAA Fisheries does not expect that the above impacts on designated critical habitat will be sufficient to reduce the value those areas of habitat have for the conservation of the winter-run Chinook salmon population. In general, habitat space, resources, and flow conditions are expected to be adequate to support a recovered population.

PAGE 204—VIII. CONCLUSION

2. Central Valley spring-run Chinook salmon

After reviewing the best scientific and commercial information available, the current status of the listed species, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is NOAA Fisheries biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of Central Valley spring-run Chinook salmon. Critical habitat for Central Valley spring-run Chinook salmon has not been designated, therefore, none will be affected.

PAGE 204—VIII. CONCLUSION

4. Central Valley steelhead

After reviewing the best scientific and commercial information available, the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is NOAA Fisheries biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of Central Valley steelhead. Critical habitat for Central Valley steelhead has not been designated, therefore, none will be affected.

5. Central California Coast steelhead

After reviewing the best scientific and commercial information available, the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is NOAA Fisheries biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of Central California Coast steelhead. Critical habitat for Central California Coast steelhead has not been designated, therefore, none will be affected.

PAGE 204—VIII. CONCLUSION

B. Early Consultation

2. Central Valley spring-run Chinook salmon

After reviewing the best scientific and commercial information available, the current status of the listed species, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is NOAA Fisheries, preliminary biological opinion that the early consultation actions, as proposed, are not likely to jeopardize the continued existence of Central Valley spring-run Chinook salmon. Critical habitat for Central Valley spring-run Chinook salmon has not been designated, therefore, none will be affected.

4. Central Valley steelhead

After reviewing the best scientific and commercial information available, the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is NOAA Fisheries preliminary biological opinion that the early consultation actions, as proposed, are not likely to jeopardize the continued existence of Central Valley steelhead. Critical habitat for Central Valley steelhead has not been designated, therefore, none will be affected.

5. Central California Coast steelhead

After reviewing the best scientific and commercial information available, the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is NOAA Fisheries preliminary biological opinion that the early consultation actions, as proposed, are not likely to jeopardize the continued existence of Central California Coast steelhead. Critical habitat for Central California Coast steelhead has not been designated, therefore, none will be affected.

PAGE 227—D. FORMAL CONSULTATION—TERMS AND CONDITIONS

Oroville Reservoir and Feather River Operations

16. The California Department of Water Resources (DWR) shall investigate and implement all measures practicable to avoid or minimize adverse effects of Oroville Reservoir operations and to improve natural production of Central Valley spring-run Chinook salmon and Central Valley steelhead in the Feather River below Oroville Dam.

    a. DWR will establish and chair a Feather River Interagency Anadromous Fishery Technical Team (Feather River Technical Team). The Feather River Technical Team should include fishery biologists, hatchery specialists, and river morphology specialists from DWR, DFG, FWS, and NOAA Fisheries. The Feather River Technical Team will meet monthly, quarterly, or as needed to review, and deliberate O&M actions that may adversely affect anadromous salmonids and their habitat, and will develop recommendations for avoiding or minimizing adverse impacts that may result from such actions.

b. DWR will coordinate Dam safety inspections that involve the need to fluctuate flows in the low flow channel to ensure the inspections are conducted at a time or in a manner that minimize the potential for adverse effects to spawning and/or rearing salmon and steelhead without affecting flood control or water supply operations and minimizes effects on power generation.

c. During periods outside of flood control operations and to the extent controllable during flood control operations, DWR shall ramp down releases to the low flow channel as presented in the table below:

Feather River Low-Flow Channel Releases (cfs)	Rate of Decrease (cfs) per 24 hours
5,000 to 3,501	1,000
3,500 to 2,501	500
2,500 to 600	300

d. DWR shall provide a written report containing the results of rotary screw traps, fyke traps, snorkel surveys, creel census and tissue sampling for monitoring studies to NOAA Fisheries (Southwest Region, Protected Resources Division, Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, California 95814-4706). In addition, DWR will continue with the stranding and isolation study as proposed in the project description. A written report summarizing study findings shall be provided to NOAA Fisheries annually, no later than December 31, each year. Additional studies are needed to determine (1) in-river abundance, (2) spawning habitat utilization, and (3) suitability of annual flow patterns for all life-stages of steelhead and spring-run Chinook salmon.

17. DWR shall manage cold water storage in Oroville Reservoir and make cold water releases from Oroville Reservoir to provide suitable spawning and rearing habitat within the Feather River for Central Valley spring-run Chinook salmon and Central Valley steelhead between the Fish Barrier Dam and Robinson Riffle (RM 61.6).

DWR shall maintain daily average water temperatures in the Feather River, between the Fish Barrier Dam and Robinson Riffle (RM 61.6) from June 1 through September 30 less than or equal to 65 °F to protect over-summering steelhead. This term is not intended to preclude pump-back operations at the Oroville Facilities that are needed to assist the State of California with supplying energy during periods when the California ISO has anticipated Stage 2 or higher alerts.

b. DWR shall consult with the Feather River Technical Team and receive approval from NOAA Fisheries, prior to making any necessary deviations from the average daily water temperature compliance criteria as described in 2.a above.

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